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STATISTICAL REPORT OF THE MANUFACTURING DATA OF M30A1 PROPELLANT

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The findings in this report are not to be construed as an official Department of the Army position.

Disposition

Destroy this report when no longer needed. Do not return to the originator.

Note

This report is the first in a planned series of the study of high pressure-temperature coefficient propellant for the M203 charge. Contained in this report is propellant data for FY77 and FY79 production. As data for FY80 and subsequent years becomes available, this report will be updated and continued until the high pressure-temperature coefficient problem is resolved.

Acknowledgments

The authors wish to express appreciation to Radford AAP for furnishing all manufacturing data, and to MISD for providing computer programs for speeding up the analysis.

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Abstract

The M203 propelling charge had exhibited a high lot to lot variability of gun pressure (at hot firings) in the recent production lots. A statistical analysis was conducted to search for possible cause of the variability.

A computer data file was generated for storing the data. Two computer programs provided by MISD were used for speeding up the analysis. In addition several computer programs were written to retrieve data for the plotting routine and for the stepwise regression analysis.

Two types of trends were observed from the plots and were summarized in Appendix 1. Results of the stepwise regression indicated that the pH value (Nitroguanidine) and % Total Volatile (composition) show a relatively high correlation to the gun pressure (at hot firings), also, the % Graphite (composition) and the combination of % Total Volatile (composition) and % Moisture (Potassium Sulfate) exhibit a functional relationship with the DP/DT (70 to 145)°F (difference in pressure/at different temperature range). A summary of the final regression results is presented in Appendix 2.

Some major changes in the source of ingredients and process conditions were observed from Radford Manufacturing data. In FY79, the supplier of the Ethyl Centralite was switched from Chemische Werke, West Germany to Van de Mark, New York. The source of Potassium Sulfate was also changed from Naval Ammo Depot Crane, Ind. to Mellinekrodt Inc. In the same year, the amount of graphite added to the process of blending/glazing was reduced from 5 lb 6.4 oz to 3 lb per 5400 pounds of propellant.

Introduction

M30A1 propellant produced in FY77 for the 155MM M203 propelling charge exhibited a pressure - temperature coefficient of approximately 60 psi/^{o}F at the temperature range from 70^{o}F (ambient) to 145^{o}F (hot). All the hot firings of these particular M203 prop charges resulted in relatively low pressures. The same type of propellant manufactured in FY79 has exhibited a pressure temperature coefficient of about double the coefficient observed in FY77 production. The hot firings in this case have resulted in higher pressures. These high pressures have significantly reduced the safety margin between the service pressure and maximum pressure requirements, which were enjoyed from FY77 production.

To investigate the cause of variability of the pressure - temperature coefficient, Radford AAP was requested to furnish all manufacturing data including those acceptance test results of all ingredients.

This report is a statistical analysis of all the data provided by Radford AAP.

Discussion

A statistical analysis of all manufacturing data including the acceptance test results of all ingredients was conducted. The purpose of this analysis is to search for any functional relationships between the manufacturing data and pressure - temperature coefficient. Besides the pressure - temperature coefficient, other output results, such as the closed bomb and peak chamber pressure, were also considered during the analysis. Since the output results depend highly on the manufacturing data (purity of the ingredient, process, etc) therefore, the output results in this case are defined as dependent (or response) variables and the manufacturing data defined as independent variable. The dependent and independent variables which were considered in this analysis are summarized in Table 1 and Table 2, respectively.

Two types of approach have been utilized in this analysis. The first approach is to plot the manufacturing data against the pressure - temperature coefficient or other output results. By plotting, a decreasing or increasing trend could be easily identified. The second approach is to conduct a stepwise regression analysis on those variables.

This stepwise regression is a statistical procedure of selecting the best correlated independent variables for a particular dependent variable, and fit them into a regression equation. A preselected F value, $F(1,n-2,\alpha)$, is required in this stepwise procedure and is highly dependent on the degrees of freedom (n-2; where n is the number of observation) and the specified percent of confident level (α) of the entering independent variable. The preselected F value in this particular analysis is 5.12 and was obtained from the F distribution table at F(1,7,0.95). The process of selecting is based on the partial F value calculated at each stage. If the calculated F value of a entering independent variable is greater than the preselected F value, the variable will be retained into the regression equation; otherwise, the variable will be rejected and another variable will be entered. This process is continued until no more variables will be entered and no more are rejected.

After selecting the best variables through comparison of the F values, a correlation coefficient (R^2) will be calculated. This correlation coefficient is an indicator of measuring the degree of correlation of the variables. As the correlation coefficient approaches to unity, the regression equation obtained from the stepwise procedure will become a precise model representing the relationship between the independent and dependent variables. This equation will be further used to predict the outcome of the dependent variable with a given value of the independent variable.

Because of a large amount of data involved, a computer data file was then generated to store them. Two computer programs provided by MISD were utilized to speed up the analysis. One program is used to plot graphs and the other one is used to conduct the stepwise regression analysis. Several computer programs were also prepared to retrieve data for plotting and as well as for the stepwise regression analysis.

After plotting all the manufacturing data against the pressure data or other output tested results, two types of trends were actually observed with the following classification (a) strong trend (b) slight trend. Both of these trends are summarized in appendix 1.

Four independent variables which belong to the strong trend catagory have been retrieved for the stepwise regression analysis. The dependent variables which are used in the regression are the pressure data (fired at 145°F) and DP/DT (70 to 145°F, difference of pressure data at the temperature range from 70 to 145°F). The result of the regression has indicated that the pH value (nitroguanidine), contained F value equal to 15.837, and % graphite, contained F value equal to 30.90, show a relatively high correlation to the pressure at 145°F and DP/DT (70 to 145)°F, respectively. A summary of the final result of regression analysis is presented in Appendix 2.

One major problem noted during the analysis was that some data represented the ingredients at time of purchase rather than when it was utilized. For example, all the average particle diameters of the nitroguanidine were measured at the source. This material was then stored for several years before use. Because of inadequate storage conditions, the crystal structure is believed to have grown. Although this report showed no correlation of nitroguanidine size with pressure obtained, analysis of particle size at the time of use might correlate. But this additional data was not available at the time of this analysis. Also some parameters upon review showed little to no variation in recorded values and were not utilized in this analysis. In addition, some major changes which were noted from the Radford manufacturing data are important enough to be mentioned in this report. These changes are as follows:

1. Changes in source of ingredients:

a. In 1977, the original supplier of Ethyl Centralite was Chemische Werke, West Germany. In FY79, Van De Mark, New York has become the new supplier of this ingredient.

b. Potassium Sulfate was originally obtained from Naval Ammo Depot Crane (manufacturer unknown) and is currently obtained from Mallinckrodt.

2. Changes in process conditions: In FY79 the amount of graphite added to the process of blending/glazing was reduced from 5 lb 6.4 oz to 3 lb per 5400 pounds of propellant.

Conclusions

1. The analysis of data showed the following:

a. Data plottings of independent variables (e.g. % Total Volatile, % Ethyl Centralite, etc.) vs dependent variables (e.g. pressure at 145°F, DP/DT (70 to 145)°F, RQ, etc) indicates the existance of strong and slight trends (see Appendix 1). For example, several independent variables (e.g. % Graphite, % Total Volatile, pH of Nitroguanidine, etc.) appear strongly to increase the pressure (145°F) of the propellant.

b. Results of stepwise regression analysis indicated that the pH of Nitroguanidine and % Graphite in the propellant show a relatively high correlation to the pressure at 145°F and DP/DT (70 to 145)°F (difference of pressure at temperature range from 70 to 145°F), respectively. A summary of the final results is presented in Apendix 2.

2. There was insufficient data available to determine the following:

a. If changes in physical data of a constituent material from time of manufacture to the time of incorporation into the propellant affect the pressures obtained.

b. If changes in sources of supply of constituent materials affect pressures obtained.

c. If changes in process conditions affect pressures obtained.

Recommendations

Based on the preliminary results obtained, it is recommended that the study be continued to:

a. Evaluate those parameters which appear to cause pressure increase.

b. Determine if the following factors affect the pressure observed:

1. Aging /storage conditions of constituent materials.
2. Changes in source of supply of constituent materials.
3. Changes in propellant processing conditions.

References

N.R. Draper, H. Smith, "Applied Regression Analysis". Wiley

Table 1:
Summary of the dependent variables used in the plotting:

		Explanation
1.	Pressure -65	Fired at $-65^{\circ}F$
2.	Pressure 70	Fired at $70^{\circ}F$
3.	Pressure 145	Fired at $145^{\circ}F$
4.	DP/DT_1. $(-65\ -145)^{\circ}F$	(Pressure $145^{\circ}F$ minus Pressure $-65^{\circ}F$)/(210 X100)
5.	DP/DT_2 $(70\ -145)^{\circ}F$	(Pressure $145^{\circ}F$ minus Pressure $70^{\circ}F$)/(75 X100)
6.	DP/DT_3 $(-65\ -70)^{\circ}F$	(Pressure $70^{\circ}F$ minus Pressure $-65^{\circ}F$)/(135 X 100)
7.	RQ90 -(RQ-40)	Relative Quickness $90^{\circ}F$ minus Relative Quickness $-40^{\circ}F$
8.	RF90 -(RF-40)	Relative Force $90^{\circ}F$ minus Relative Force $-40^{\circ}F$
9.	$\frac{DP(TEST)}{DP\ (CALI)}/DT_1$ $(-65\ -145)^{\circ}F$	$\frac{\text{Test Rd (Pressure } 145^{\circ}F \text{ minus Pressure } -65^{\circ}F)}{\text{Cali RD (Pressure } 145^{\circ}F \text{ minus Pressure } -65^{\circ}F)}$
10.	$\frac{DP(TEST)}{DP\ (CALI)}_{DT2}$ $(70\ -\ 145)^{\circ}F$	$\frac{\text{Test RD (Pressure } 145^{\circ}F \text{ minus Pressure } 70^{\circ}F)}{\text{CALI RD (Pressure } 145^{\circ}F \text{ minus Pressure } 70^{\circ}F)}$

Table 2

Summary of Independent Variables Used In The Plotting

		/ Short Title Used in The Plots
1.	% Nitrogen	(Nitrocellulose)
2.	Fineness	(")
3.	% Ash	(")
4.	Viscosity	(")
5.	Freeness	(") Free (NC)
6.	% Water	(Nitroglycerine)
7.	% Nitrogen	(")
8.	Average Particle Size	(Nitroguanidine)
9.	% Ash	(")
10.	pH Value	(") pH (NGU)
11.	Total Volatiles	(")
12.	% Sulfates	(")
13.	Solidification Point ^{o}C	(Ethyl Centralyte)

14.	Volatile Content	(")	V.C. (ETH)
15.	% Ash Content	(")	
16.	Sum of Amines	(")	
17.	% Moisture	(Potassium Sulfate)	Mois (PS)
18.	% Moisture	(Graphite, Grade 4)	
19.	% Ash	(")	% Ash (G4)
20.	Granulation	(")	
21.	Nitrocellulose	(% Composition)	
22.	Nitroglycerine	(")	
23.	Nitroguanidine	(")	
24.	Ethyl Centralite	(")	E.C. (%C)
25.	Potassium Sulfate	(% Composition)	
26.	Total Volatiles	(% Composition)	T.V. (%C)

27.	Graphite, Grade 4	(")	G4 (%C)
28.	Length	(Grain Dimensions)	
29.	Diameter	(")	
30.	Perforation	(")	
31.	Iner Web	(")	
32.	Outer Web	(")	
33.	Avg Web	(")	
34.	Web Difference	(")	
35.	L/D	(")	
36.	L/d	(")	
37.	L Uniformity	(")	L UNI (GD)
38.	D Uniformity	(")	D UNI (GD)
39.	Year Storage of Nitroguaandine		Yr (STORAGE) NGU

Table 3:
Result of plots with strong trends and slight trends

Independent Variable \ Dependent Variable	Pressure -65	Pressure 70	Pressure 145	DP/DT_1 (-65-145)°F	DP/DT_2 (70-145)°F	DP/DT_3 DT_3 - (-65-70)°F	RQ 90 - (RQ-40)	RF 90- (RF-40)	DP (TEST) CP (CALC) (-65-145°F	DP (TEST) DP (CALC) (70-145)°F
pH Value (Nitroguanidine)			S	W	W		W		W	W
% Moisture (Potassium Sul)	W	W	W	W	S		S		S	S
% Ash (Graphite)				S	S		S		S	S
Volatile Content (Ethyl Centralite)		W	W		W					
% Nitrogen (NItrocellulose)		W								
Viscosity (Nitrocellulose)				W						
Freeness (Nitrocellulose)		W		W	W		W		W	W
Total Volatile (% Comp)			S							
Ethyl Centralite (% Comp)			W		W		W		W	W
Graphite (% Comp)				S	S		S		S	S
Nitroglycerine (Comp)	W					W				
Length of Grain			W							
Perforation Diameter	W									
D/d					W					
Length Uniformity of Grain		W			W					
Diameter Uniformity of Grain			W		W					
Year Storage of Nitroguanidine		W		S		W		S	S	

S = Strong trend
W = Slight trend

Appendix 1: Evaluation of Computer Graph Output
As previously mentioned all plots were generated by a computer program. A title and a table of data appear on every plots. The values listed at the left side of the table are the values of the independent variable and were plotted on the X coordinate; likewise, the values at the right side are belonged to the dependent variable and were designated on Y coordinate. These pairs of X,Y values are arranged in a chronological order. A symbol ✕ on the plot is an indication of the first pair of X, Y value being plotted. The rest of data was then plotted and connected by the lines in a chronological order.

Types of trends observed from the plots are summarized below.

A. Summary of The Strong Trend Plots

Fig #	Independent Variable	Vs.	Dependent Variable
1	pH Value (Nitroguanidine)		Pressure at 145°F
2	Total Volatile (% Composition)		Pressure at 145°F
3	% Ethyl Centralite (% Composition)		Pressure at 145°F
4-7	% Moisture (Potassium Sulfate)		$DP/_{DT_2}$ (70 -145)°F
8-11	Total Volatile (% Composition)		$\frac{DP\ TEST}{DP\ CALI}$ $/DT_2$ (70 -145°F)
			$\frac{DP\ TEST}{DP\ CALI}/DT_1$(-65 -145°F)
			RQ90 - (RQ -40)
12-16	% Graphite (% Composition)		$DP/_{DT_1}$ (-65 -145°F)
17-21	% ASH (in Graphite)		$DP/_{DT_2}$ (70 -145)°F
			$\frac{DP\ (TEST)}{DP\ (CALI)}$ $/DT_1$ (70 -145)°F
			$\frac{DP\ (TEST)/}{DP\ (CALI)/}DT_2$(-65 -145)°F
			RQ90 - (RQ -40)
22-24	Yr (Storage) Nitroguanidine		DP/DT_2 (70 -145)°F
			$\frac{DP\ TEST}{DP\ CALI}/DT_2$ (70 -145)°F
			$\frac{DP\ TEST}{DP\ CALI}/DT_1$(-65 -145)°F

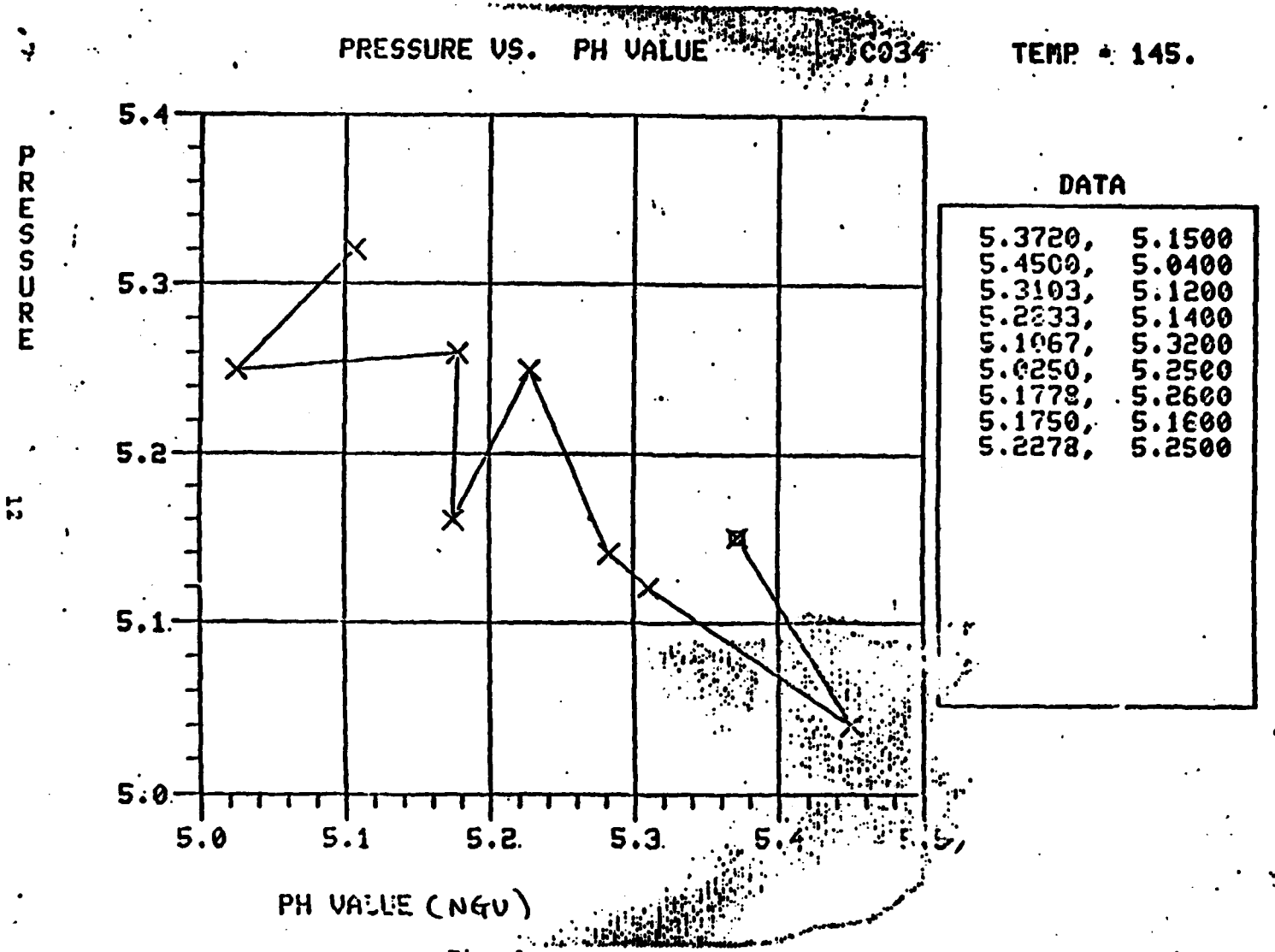

PRESSURE VS. PH VALUE
C034
TEMP = 145.
PRESSURE
5.4
5.3
5.2
5.1
5.0
5.0
5.1
5.2
5.3
5.4
PH VALUE (NGU)
DATA
5.3720, 5.1500
5.4500, 5.0400
5.3103, 5.1200
5.2233, 5.1400
5.1067, 5.3200
5.0250, 5.2500
5.1778, 5.2600
5.1750, 5.1600
5.2278, 5.2500

Fig. 1

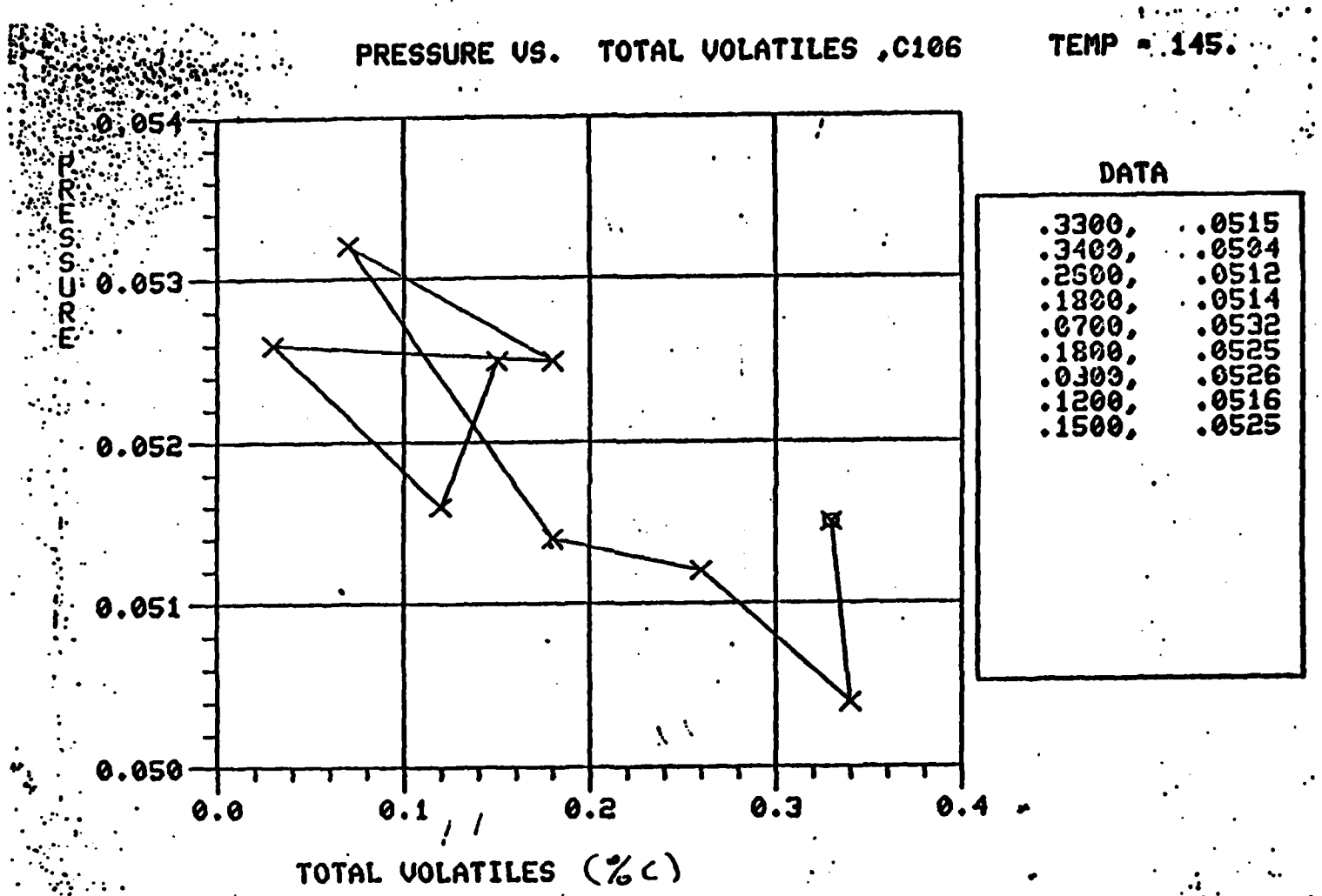

PRESSURE VS. TOTAL VOLATILES ,C106
TEMP = 145.
PRESSURE
0.054
0.053
0.052
0.051
0.050
0.0
0.1
0.2
0.3
0.4
TOTAL VOLATILES (%C)
DATA
.3300, .0515
.3400, .0504
.2500, .0512
.1800, .0514
.0700, .0532
.1800, .0525
.0300, .0526
.1200, .0516
.1500, .0525

Fig. 2

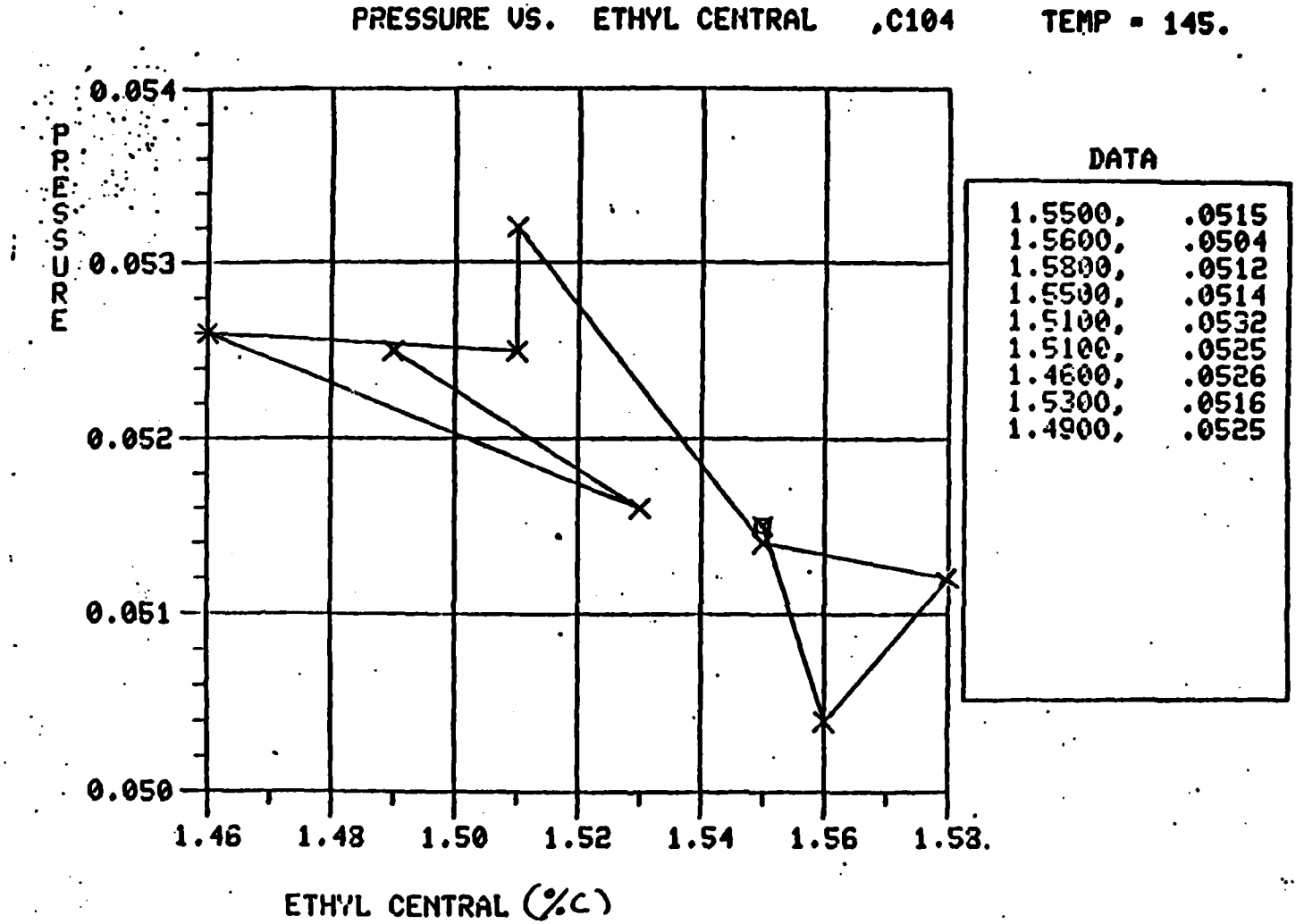

PRESSURE VS. ETHYL CENTRAL ,C104 TEMP = 145.
PRESSURE
0.054
0.053
0.052
0.051
0.050
1.46
1.48
1.50
1.52
1.54
1.56
1.58.
ETHYL CENTRAL (%C)
DATA
1.5500, .0515
1.5600, .0504
1.5800, .0512
1.5500, .0514
1.5100, .0532
1.5100, .0525
1.4600, .0526
1.5300, .0516
1.4900, .0525

Fig. 3 .

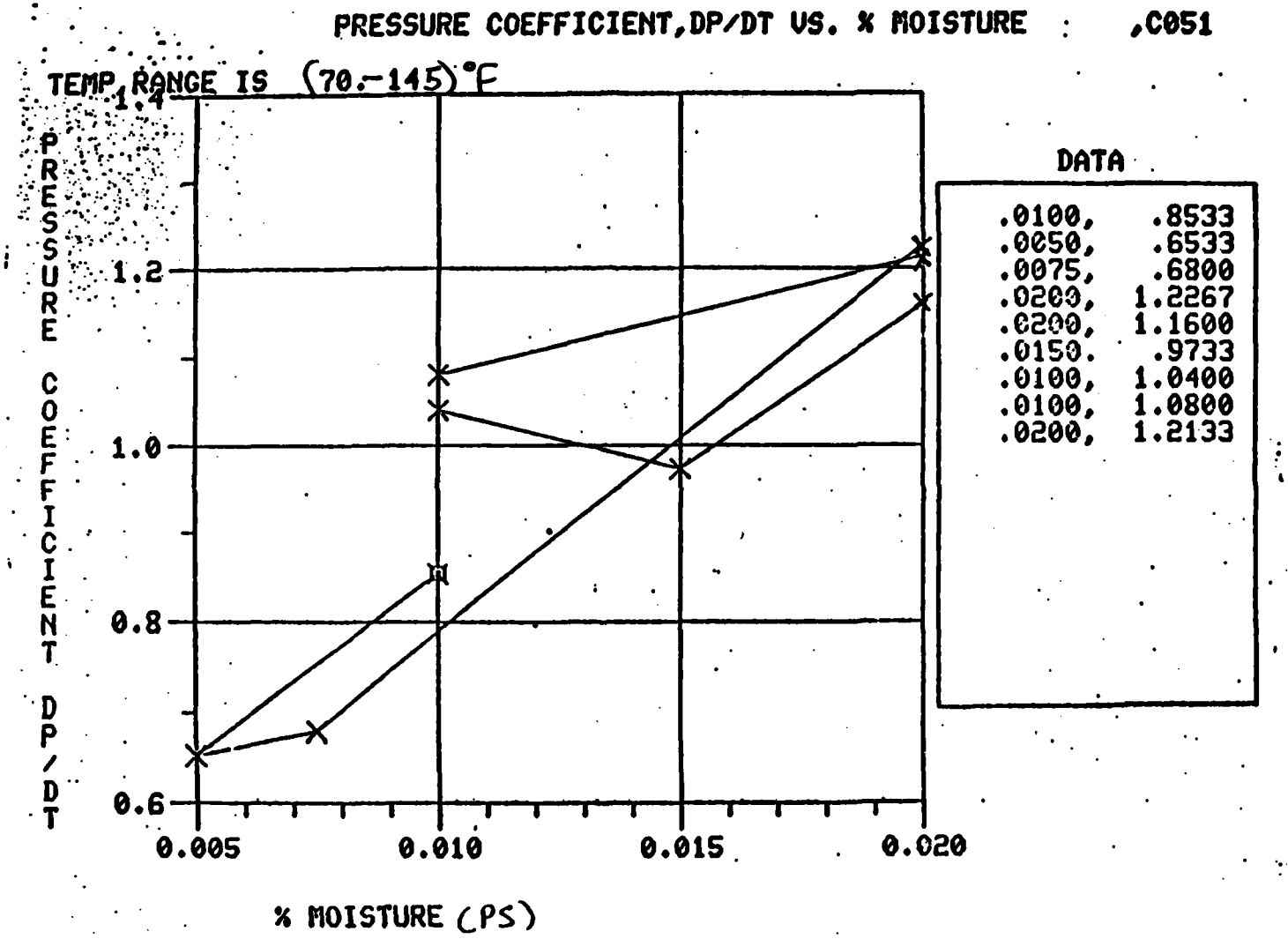

PRESSURE COEFFICIENT,DP/DT VS. % MOISTURE : ,C051
TEMP RANGE IS (70.-145)°F
PRESSURE COEFFICIENT DP/DT
1.4
1.2
1.0
0.8
0.6
0.005
0.010
0.015
0.020
% MOISTURE (PS)
DATA
.0100, .8533
.0050, .6533
.0075, .6800
.0200, 1.2267
.0200, 1.1600
.0150. .9733
.0100, 1.0400
.0100, 1.0800
.0200, 1.2133

Fig. 4

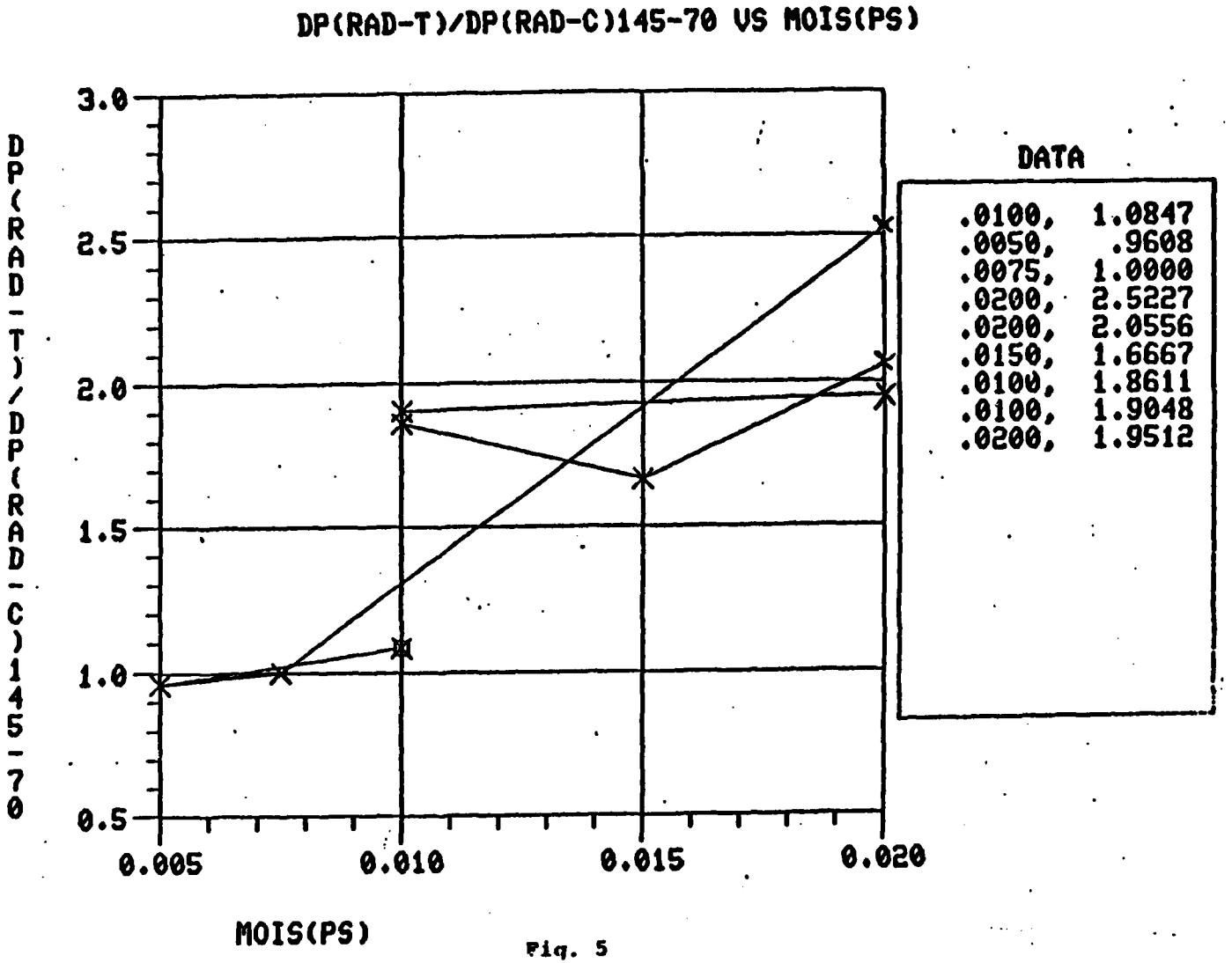

DP(RAD-T)/DP(RAD-C)145-70 VS MOIS(PS)
DP(RAD-T)/DP(RAD-C)145-70
3.0
2.5
2.0
1.5
1.0
0.5
0.005
0.010
0.015
0.020
MOIS(PS)
DATA
.0100, 1.0847
.0050, .9608
.0075, 1.0000
.0200, 2.5227
.0200, 2.0556
.0150, 1.6667
.0100, 1.8611
.0100, 1.9048
.0200, 1.9512

Fig. 5

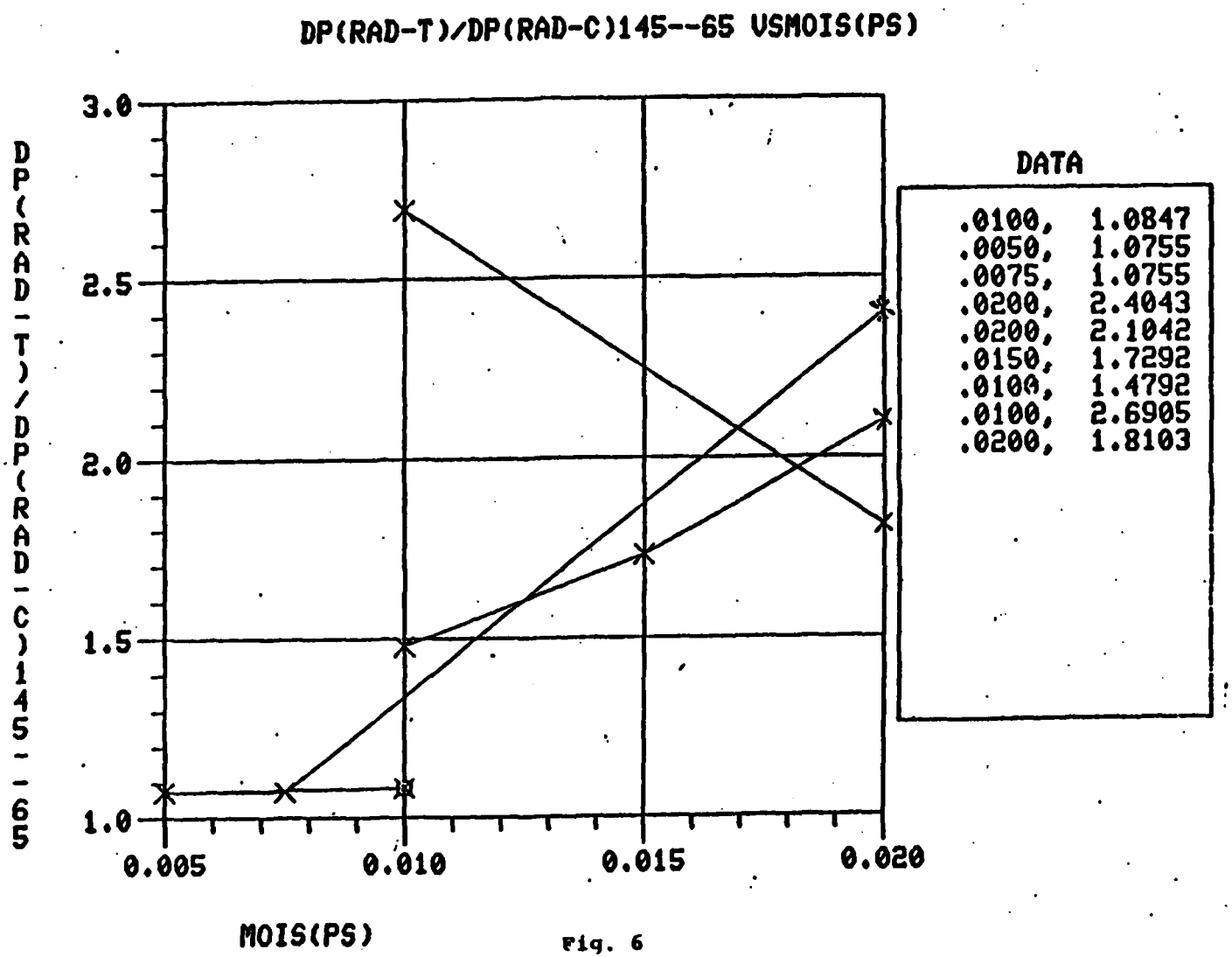

DP(RAD-T)/DP(RAD-C)145--65 VSMOIS(PS)
DP(RAD-T)/DP(RAD-C)145--65
3.0
2.5
2.0
1.5
1.0
0.005
0.010
0.015
0.020
MOIS(PS)
DATA
.0100, 1.0847
.0050, 1.0755
.0075, 1.0755
.0200, 2.4043
.0200, 2.1042
.0150, 1.7292
.0100, 1.4792
.0100, 2.6905
.0200, 1.8103

Fig. 6

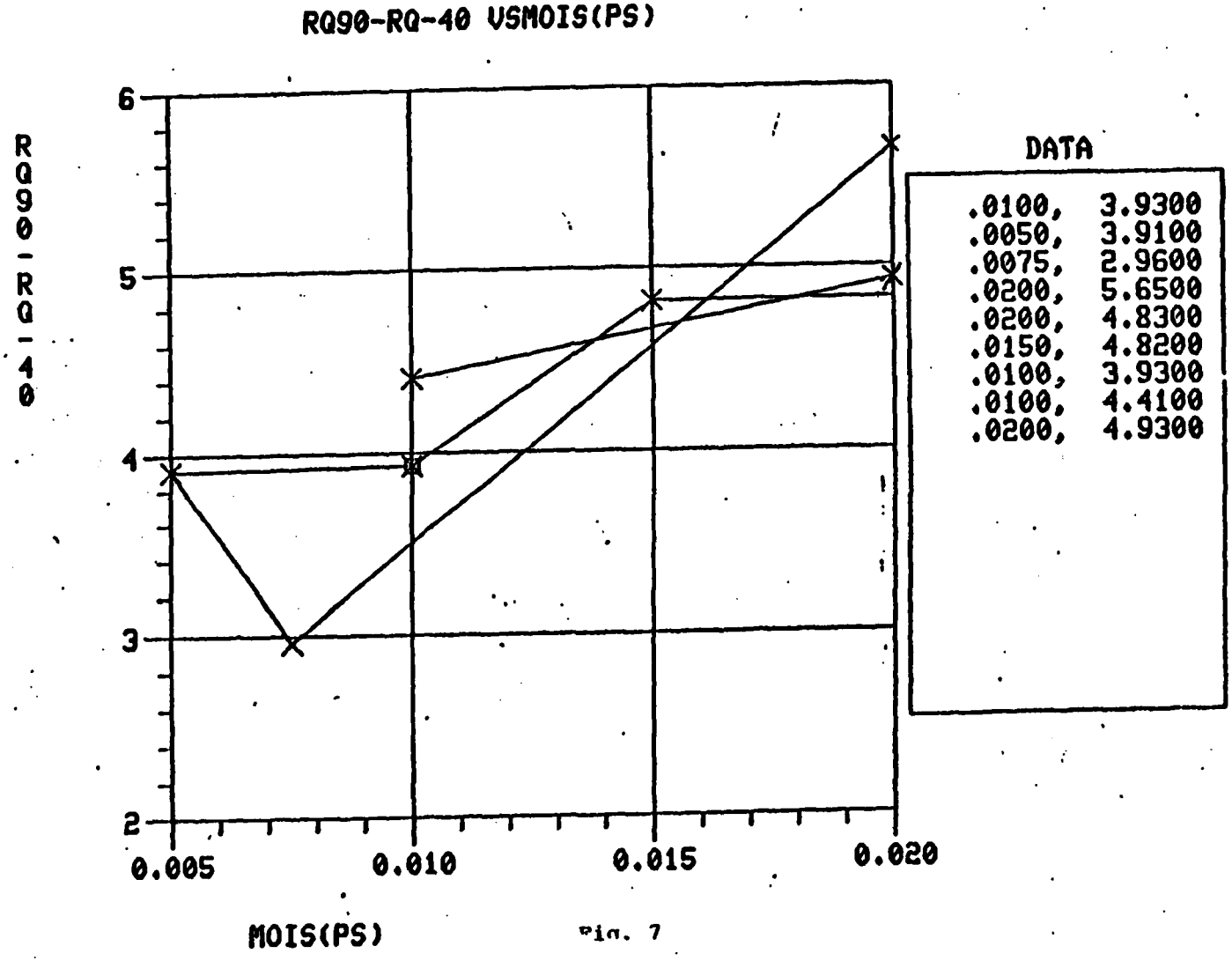

RQ90-RQ-40 VSMOIS(PS)
RQ90-RQ-40
6
5
4
3
2
0.005
0.010
0.015
0.020
MOIS(PS)
DATA
.0100, 3.9300
.0050, 3.9100
.0075, 2.9600
.0200, 5.6500
.0200, 4.8300
.0150, 4.8200
.0100, 3.9300
.0100, 4.4100
.0200, 4.9300

Fig. 7

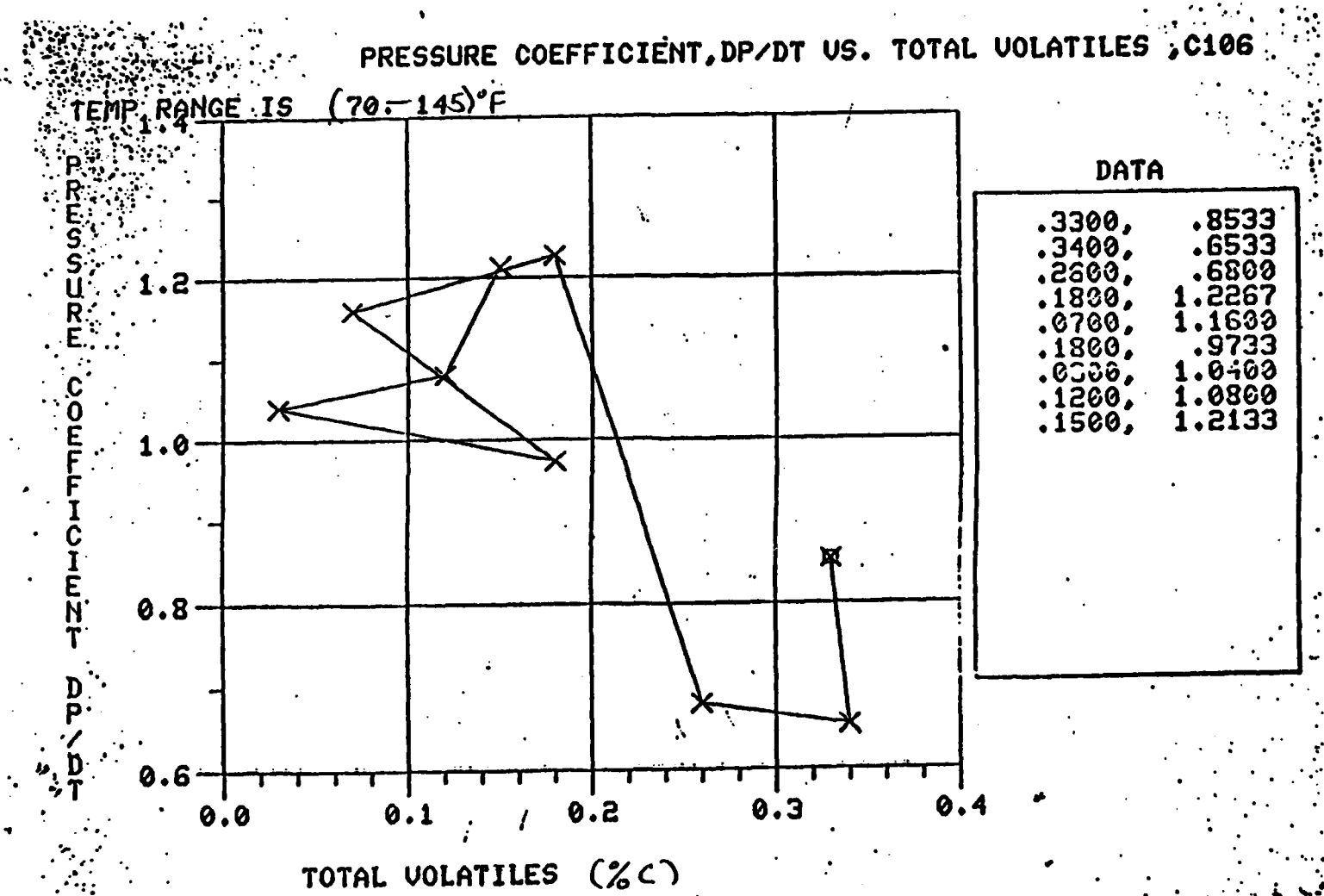
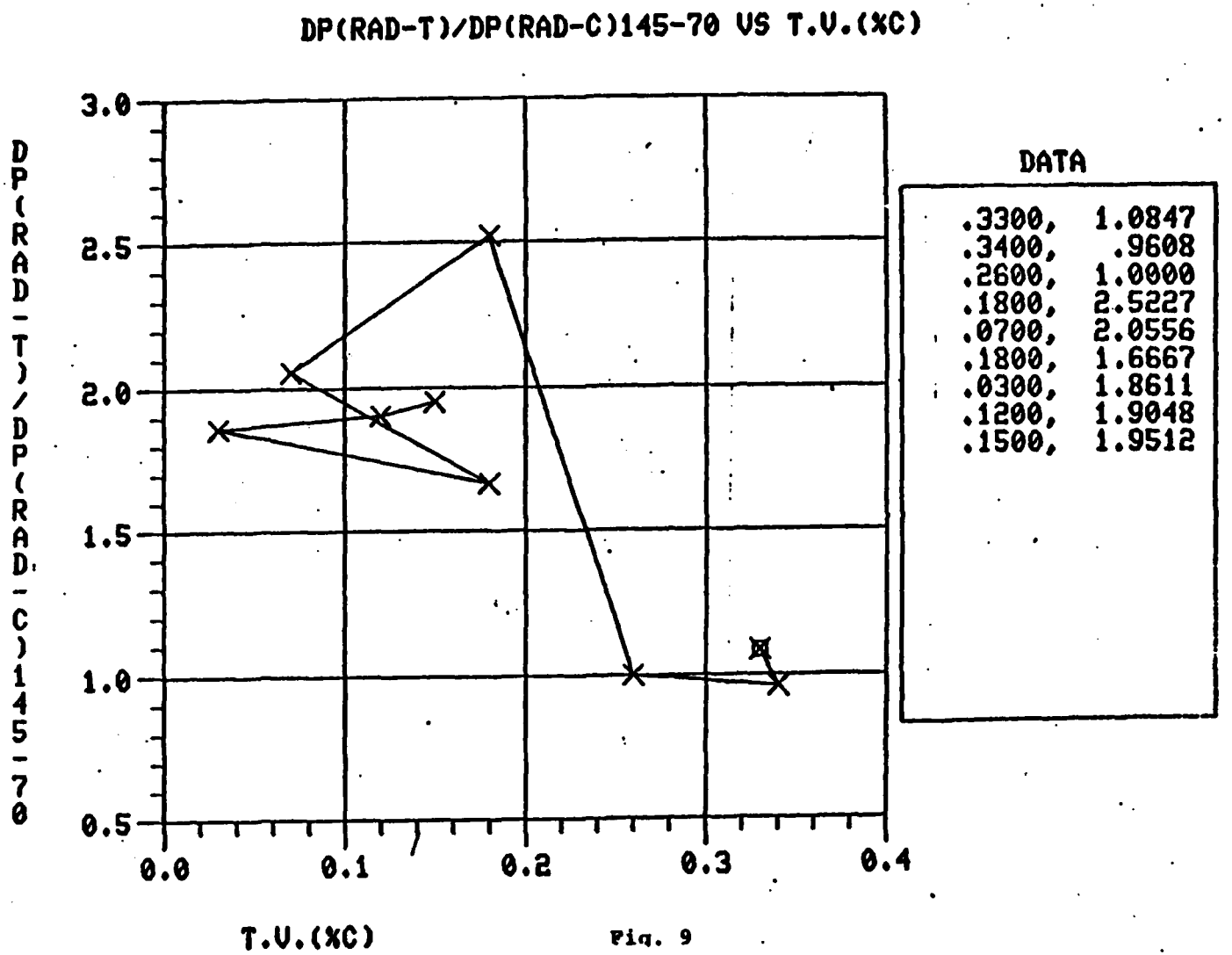

PRESSURE COEFFICIENT, DP/DT VS. TOTAL VOLATILES, C106
TEMP RANGE IS (70-145)°F
PRESSURE COEFFICIENT DP/DT
1.4
1.2
1.0
0.8
0.6
0.0
0.1
0.2
0.3
0.4
TOTAL VOLATILES (%C)
DATA
.3300, .8533
.3400, .6533
.2600, .6800
.1800, 1.2267
.0700, 1.1600
.1800, .9733
.0000, 1.0400
.1200, 1.0800
.1500, 1.2133

Fig. 8


DP(RAD-T)/DP(RAD-C)145-70 VS T.V.(%C)
DP(RAD-T)/DP(RAD-C)145-70
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.1
0.2
0.3
0.4
T.V.(%C)
DATA
.3300, 1.0847
.3400, .9608
.2600, 1.0000
.1800, 2.5227
.0700, 2.0556
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.0300, 1.8611
.1200, 1.9048
.1500, 1.9512

Fig. 9

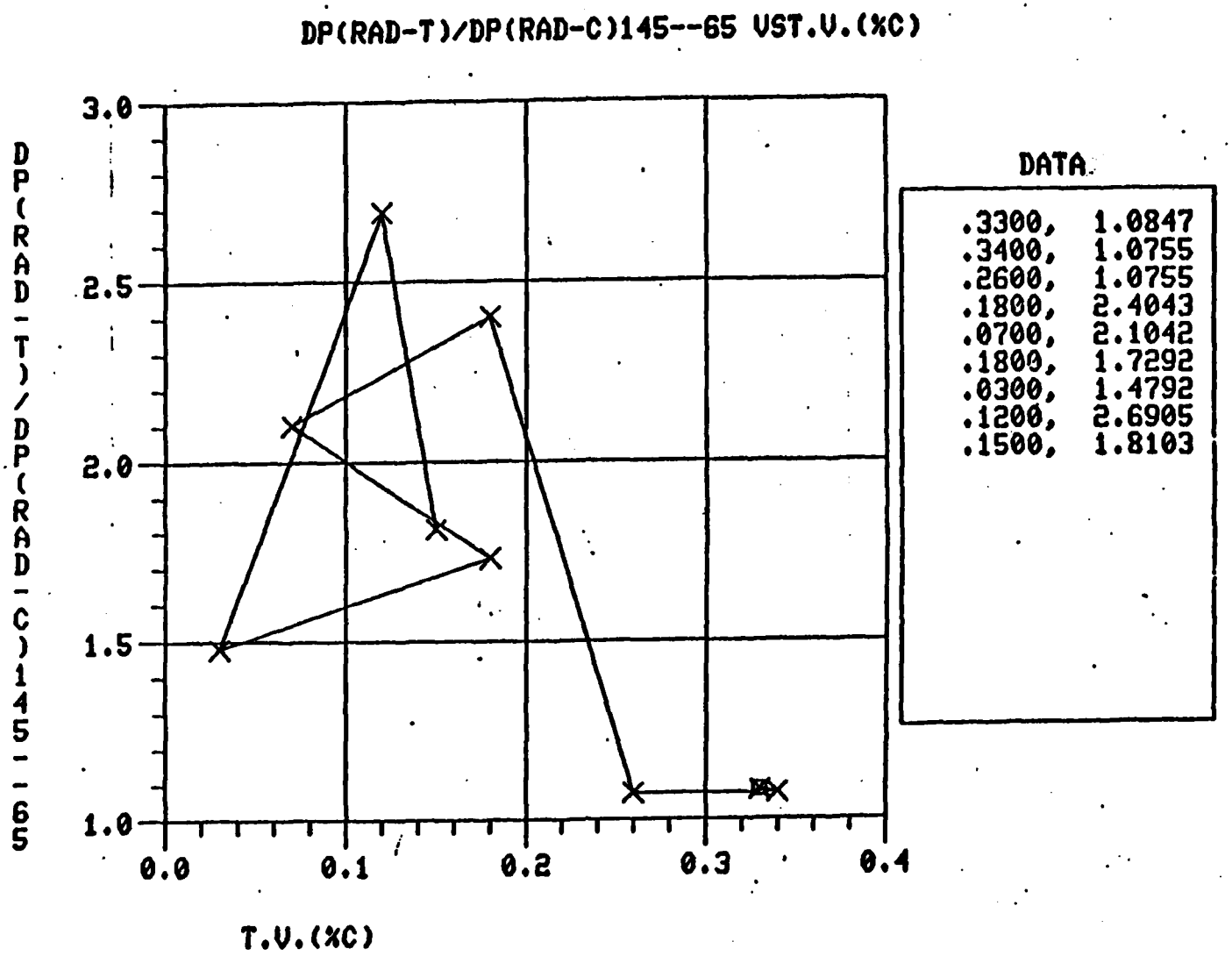

DP(RAD-T)/DP(RAD-C)145--65 VST.V.(%C)
DP(RAD-T)/DP(RAD-C)145--65
3.0
2.5
2.0
1.5
1.0
0.0
0.1
0.2
0.3
0.4
T.V.(%C)
DATA
.3300, 1.0847
.3400, 1.0755
.2600, 1.0755
.1800, 2.4043
.0700, 2.1042
.1800, 1.7292
.0300, 1.4792
.1200, 2.6905
.1500, 1.8103

Fig. 10

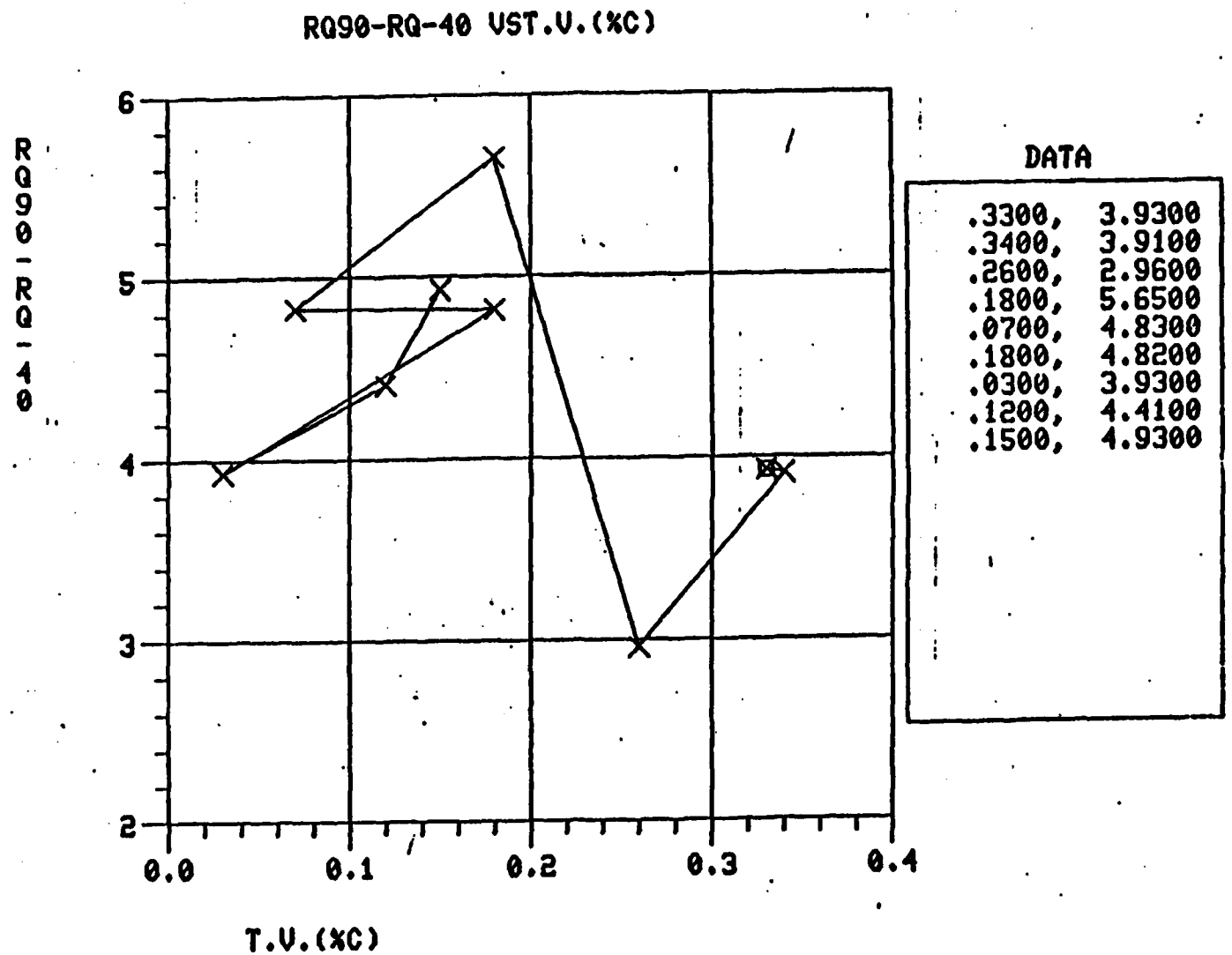

RQ90-RQ-40 VST.V.(%C)
RQ90-RQ-40
6
5
4
3
2
0.0
0.1
0.2
0.3
0.4
T.V.(%C)
DATA
.3300, 3.9300
.3400, 3.9100
.2600, 2.9600
.1800, 5.6500
.0700, 4.8300
.1800, 4.8200
.0300, 3.9300
.1200, 4.4100
.1500, 4.9300

Fig. 11

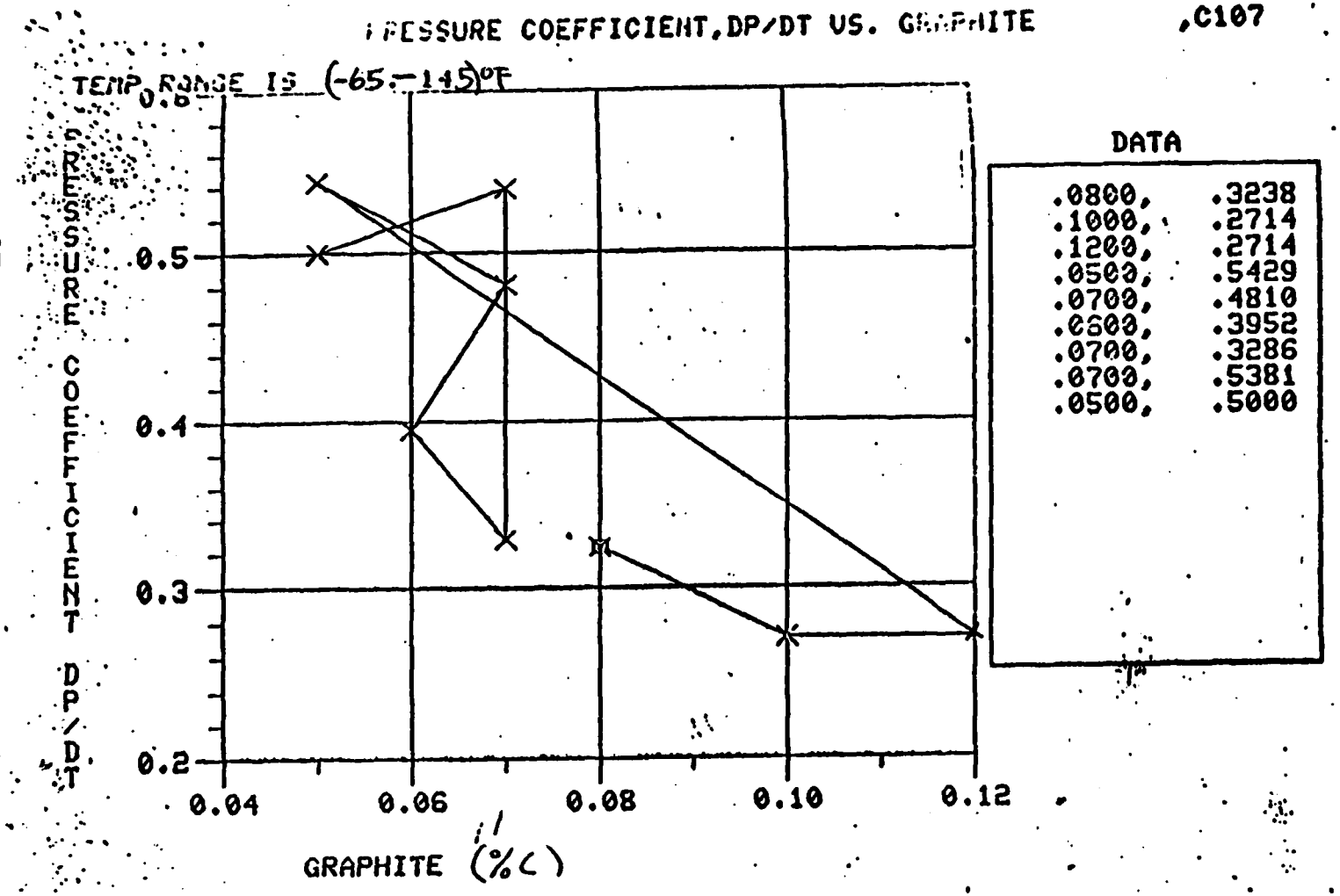

PRESSURE COEFFICIENT, DP/DT VS. GRAPHITE
,C107
TEMP RANGE IS (-65,-145)°F
PRESSURE COEFFICIENT DP/DT
0.6
0.5
0.4
0.3
0.2
0.04
0.06
0.08
0.10
0.12
GRAPHITE (%C)
DATA
.0800, .3238
.1000, .2714
.1200, .2714
.0500, .5429
.0700, .4810
.0600, .3952
.0700, .3286
.0700, .5381
.0500, .5000

Fig. 12

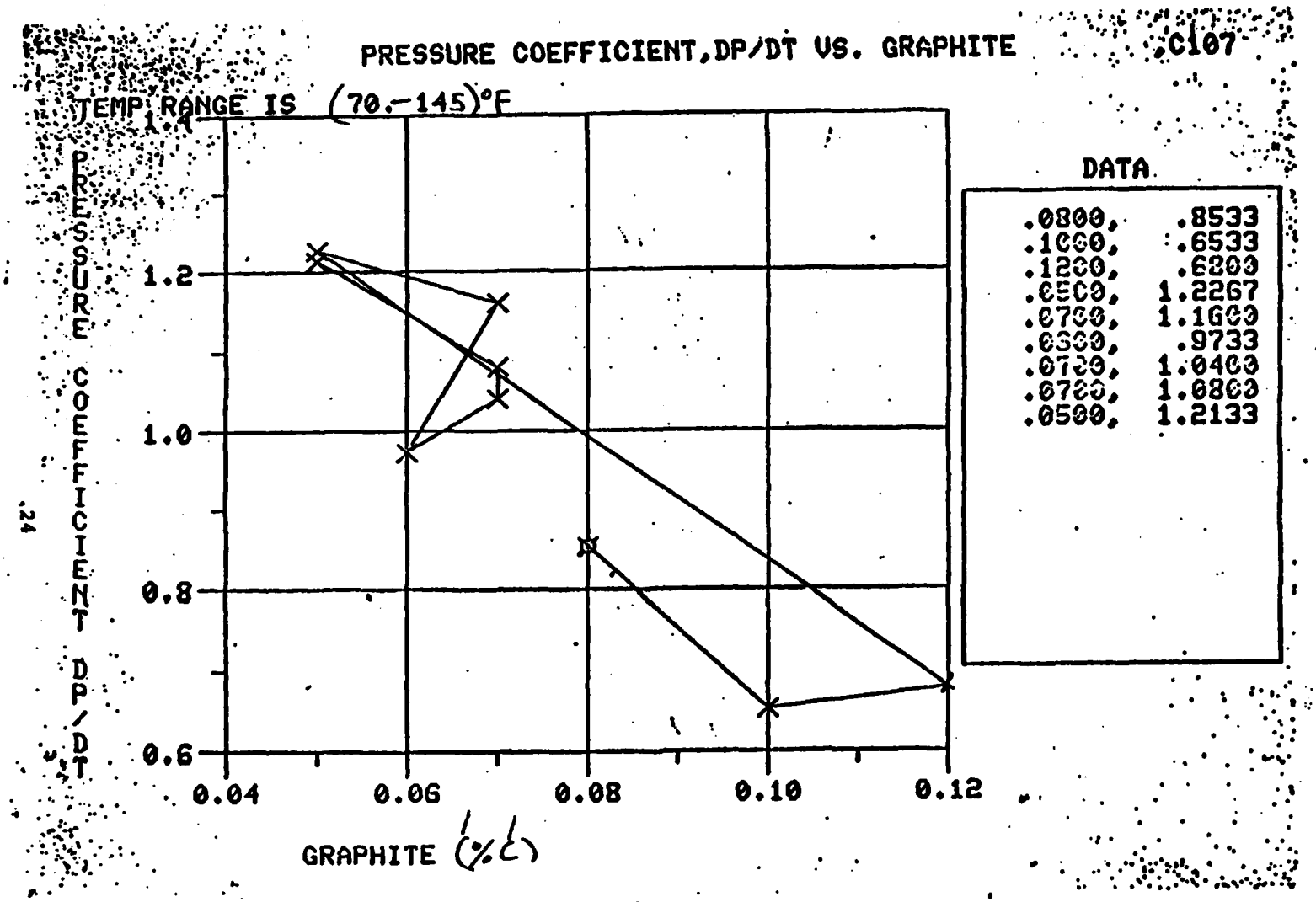

PRESSURE COEFFICIENT, DP/DT VS. GRAPHITE
C107
TEMP RANGE IS (70.-145)°F
PRESSURE COEFFICIENT DP/DT
1.4
1.2
1.0
0.8
0.6
0.04
0.06
0.08
0.10
0.12
GRAPHITE (%C)
DATA
.0800, .8533
.1000, .6533
.1200, .6800
.0800, 1.2267
.0700, 1.1600
.0900, .9733
.0700, 1.0400
.0700, 1.0800
.0500, 1.2133

Fig. 13

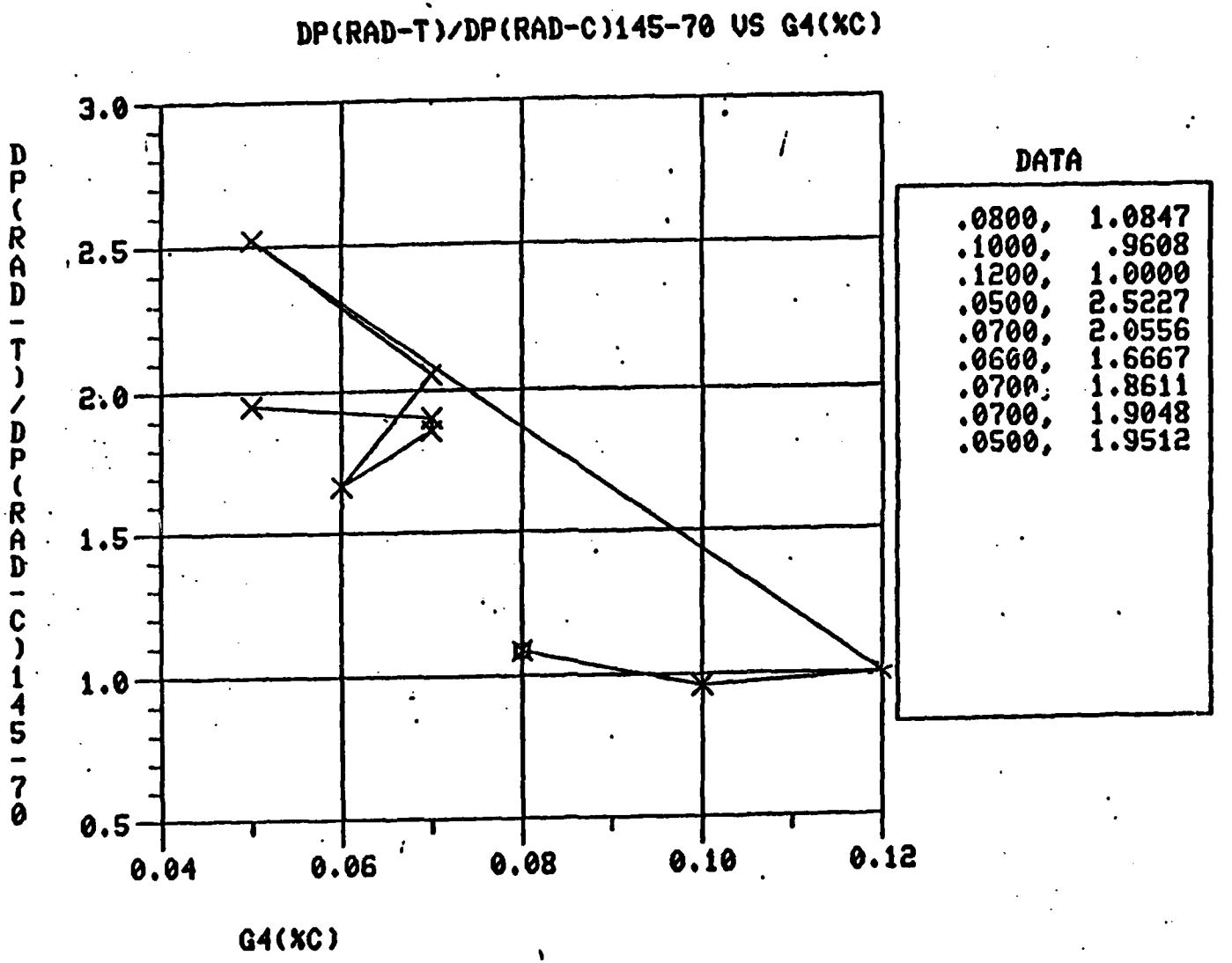

DP(RAD-T)/DP(RAD-C)145-70 VS G4(%C)
DP(RAD-T)/DP(RAD-C)145-70
3.0
2.5
2.0
1.5
1.0
0.5
0.04
0.06
0.08
0.10
0.12
G4(%C)
DATA
.0800, 1.0847
.1000, .9608
.1200, 1.0000
.0500, 2.5227
.0700, 2.0556
.0600, 1.6667
.0700, 1.8611
.0700, 1.9048
.0500, 1.9512

Fig. 14

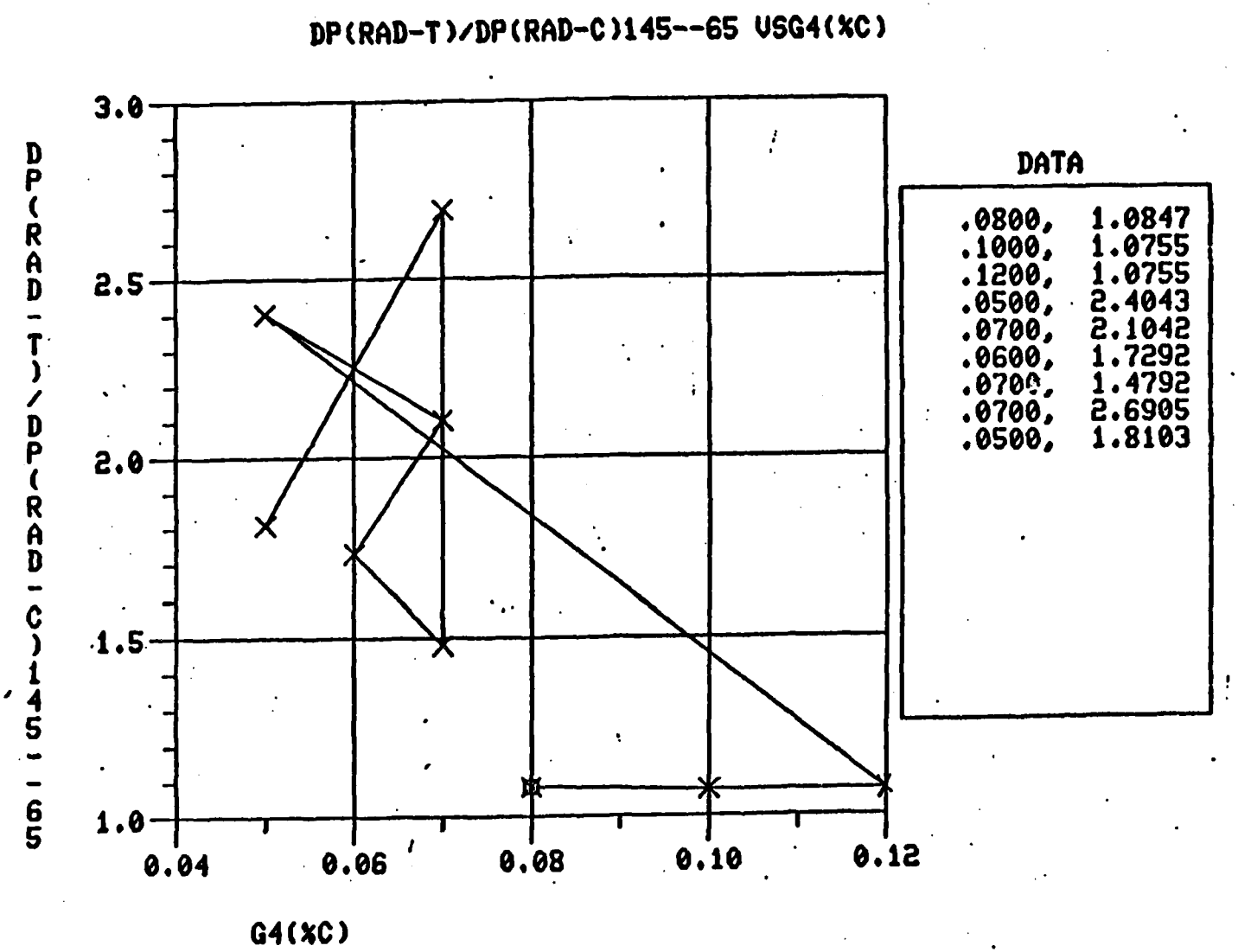

DP(RAD-T)/DP(RAD-C)145--65 VSG4(%C)
DP(RAD-T)/DP(RAD-C)145--65
3.0
2.5
2.0
1.5
1.0
0.04
0.06
0.08
0.10
0.12
G4(%C)
DATA
.0800, 1.0847
.1000, 1.0755
.1200, 1.0755
.0500, 2.4043
.0700, 2.1042
.0600, 1.7292
.0700, 1.4792
.0700, 2.6905
.0500, 1.8103

Fig. 15

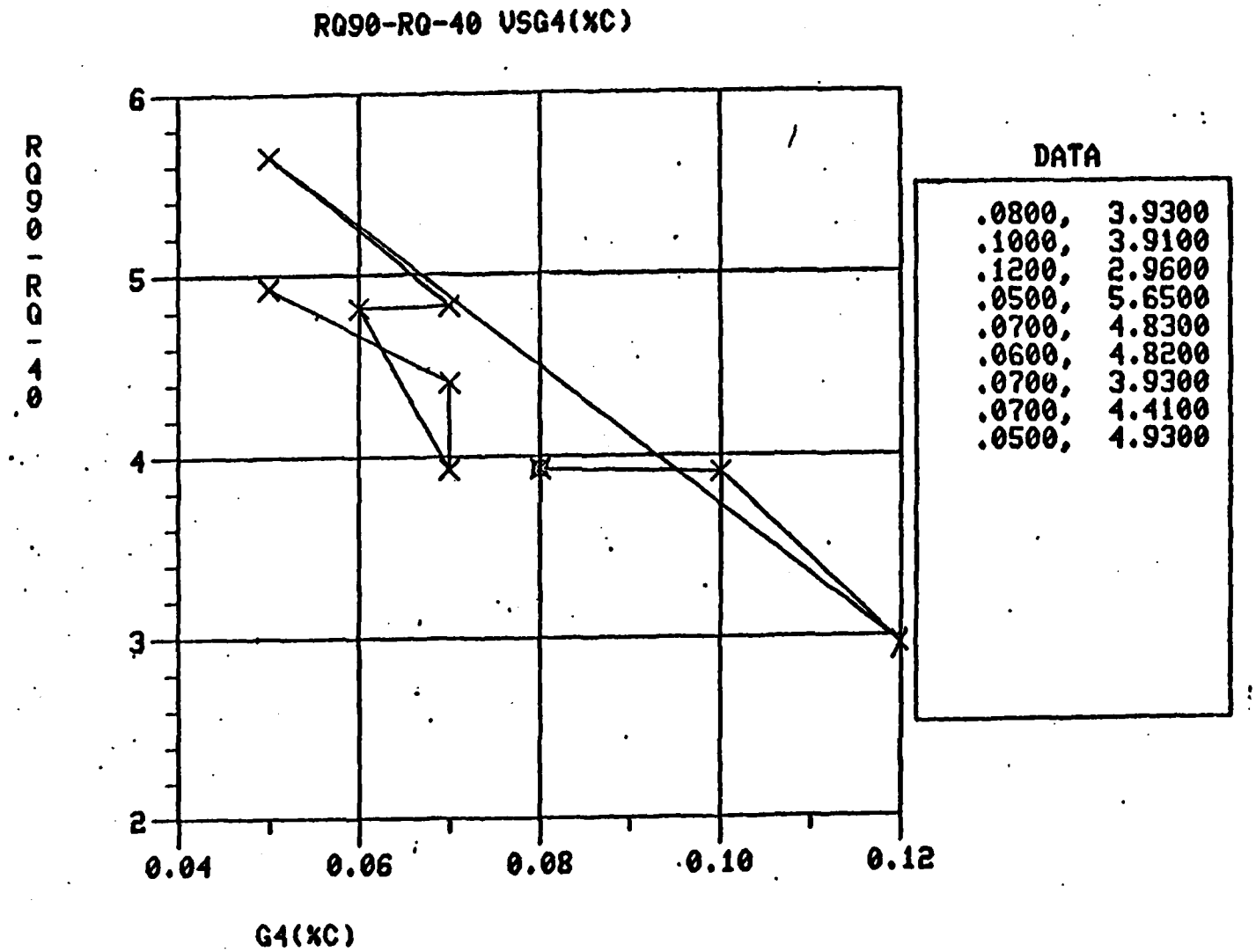

RQ90-RQ-40 VSG4(XC)
RQ90-RQ-40
6
5
4
3
2
0.04
0.06
0.08
0.10
0.12
G4(XC)
DATA
.0800, 3.9300
.1000, 3.9100
.1200, 2.9600
.0500, 5.6500
.0700, 4.8300
.0600, 4.8200
.0700, 3.9300
.0700, 4.4100
.0500, 4.9300

Fig. 16

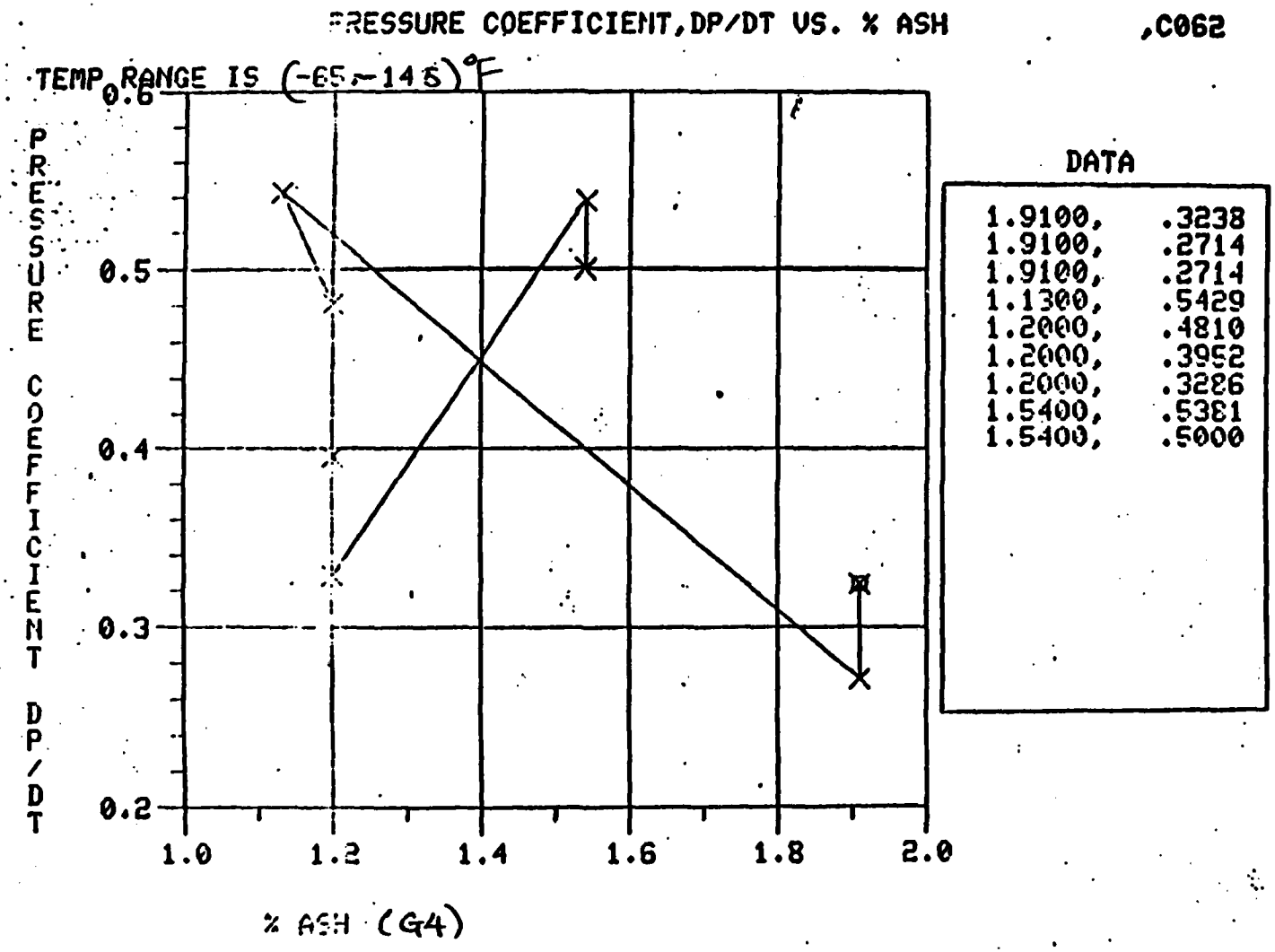

PRESSURE COEFFICIENT, DP/DT VS. % ASH ,C062
TEMP RANGE IS (-65 - 145)°F
PRESSURE COEFFICIENT DP/DT
0.6
0.5
0.4
0.3
0.2
1.0
1.2
1.4
1.6
1.8
2.0
% ASH (G4)
DATA
1.9100, .3238
1.9100, .2714
1.9100, .2714
1.1300, .5429
1.2000, .4810
1.2000, .3952
1.2000, .3286
1.5400, .5381
1.5400, .5000

Fig. 17

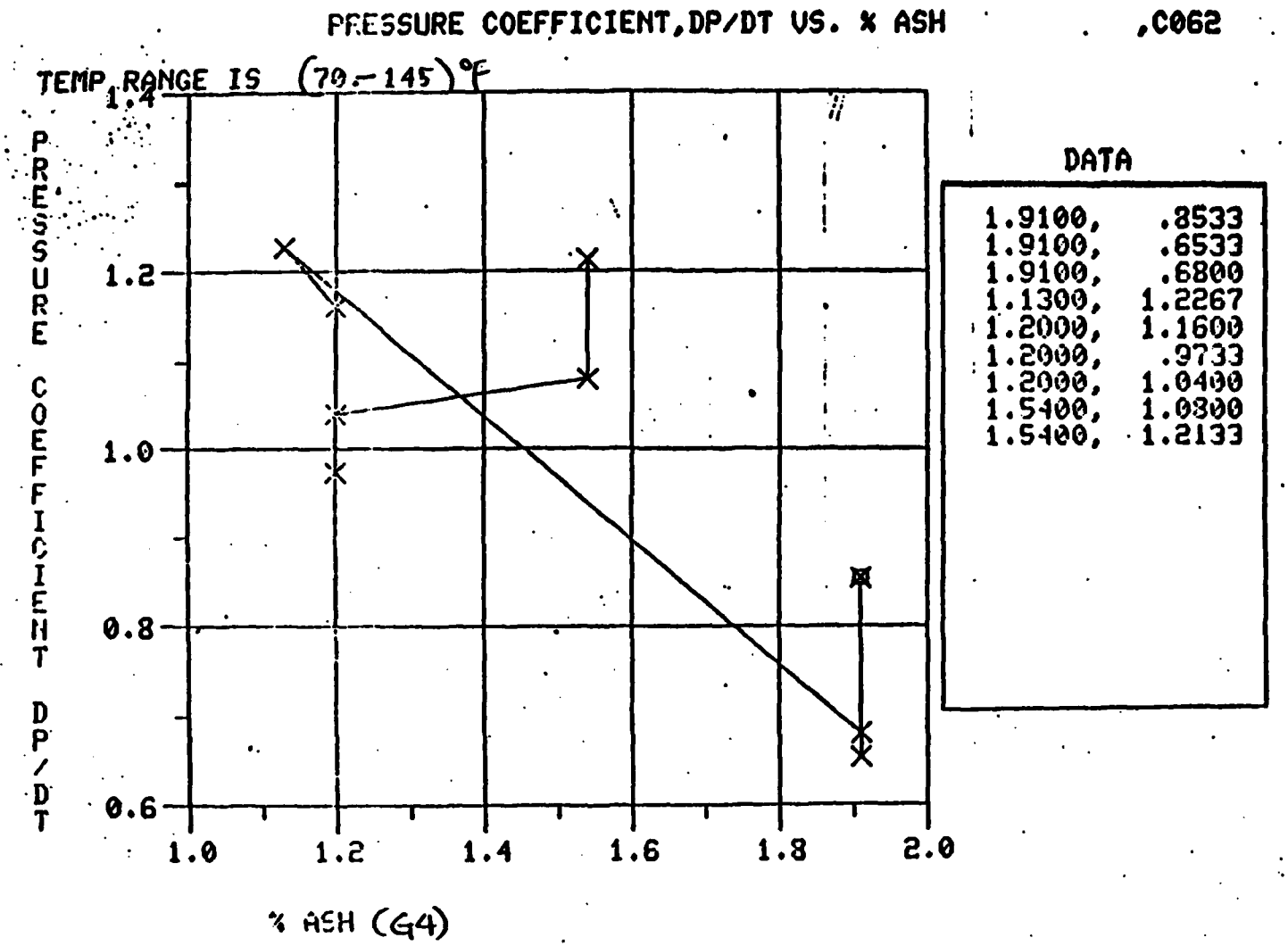

PRESSURE COEFFICIENT,DP/DT VS. % ASH ,C062
TEMP RANGE IS (70-145)°F
PRESSURE COEFFICIENT DP/DT
1.4
1.2
1.0
0.8
0.6
1.0
1.2
1.4
1.6
1.8
2.0
% ASH (G4)
DATA
1.9100, .8533
1.9100, .6533
1.9100, .6800
1.1300, 1.2267
1.2000, 1.1600
1.2000, .9733
1.2000, 1.0400
1.5400, 1.0800
1.5400, 1.2133

Fig. 18

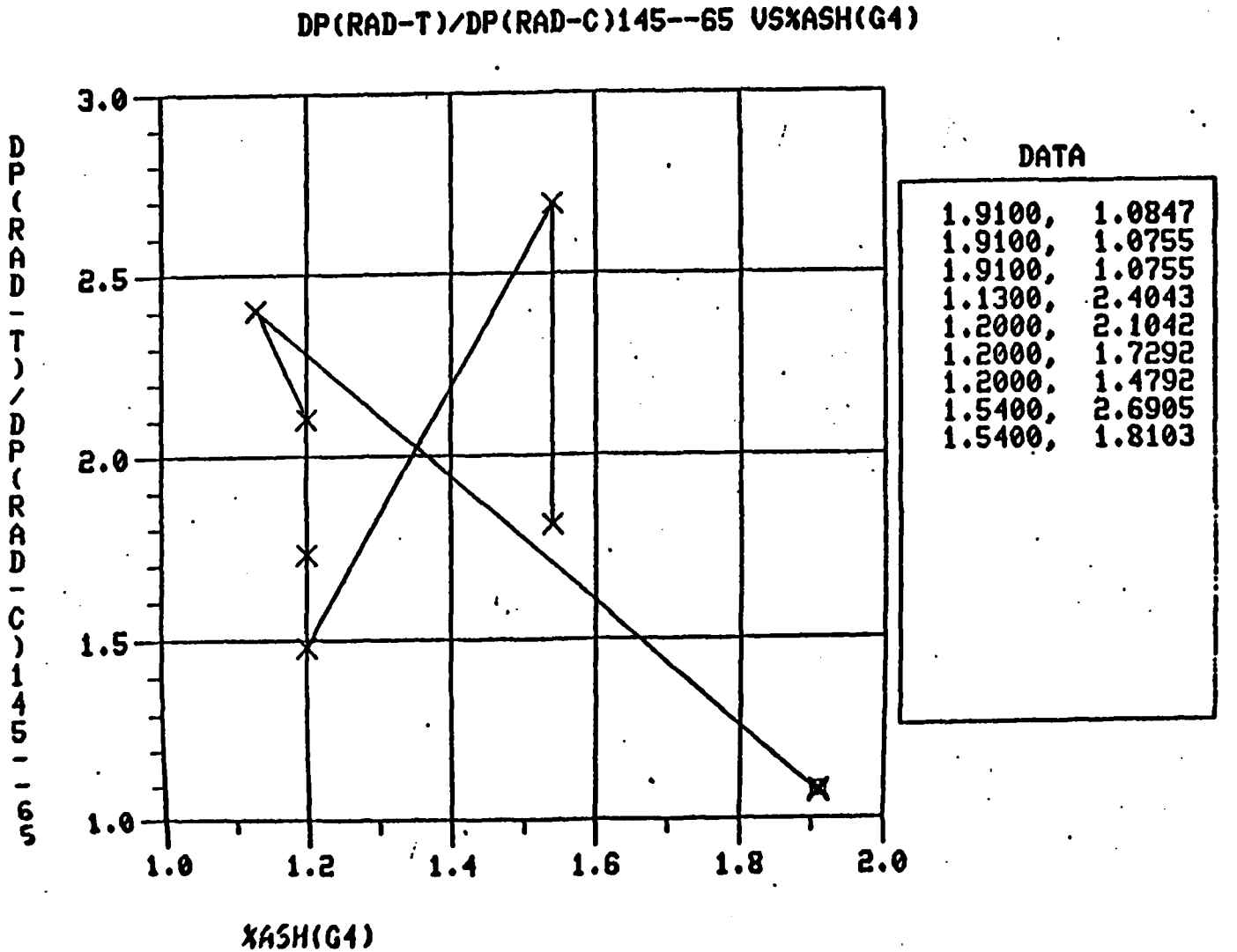

DP(RAD-T)/DP(RAD-C)145--65 VS%ASH(G4)
DP(RAD-T)/DP(RAD-C)145--65
3.0
2.5
2.0
1.5
1.0
1.0
1.2
1.4
1.6
1.8
2.0
%ASH(G4)
DATA
1.9100, 1.0847
1.9100, 1.0755
1.9100, 1.0755
1.1300, 2.4043
1.2000, 2.1042
1.2000, 1.7292
1.2000, 1.4792
1.5400, 2.6905
1.5400, 1.8103

Fig. 19

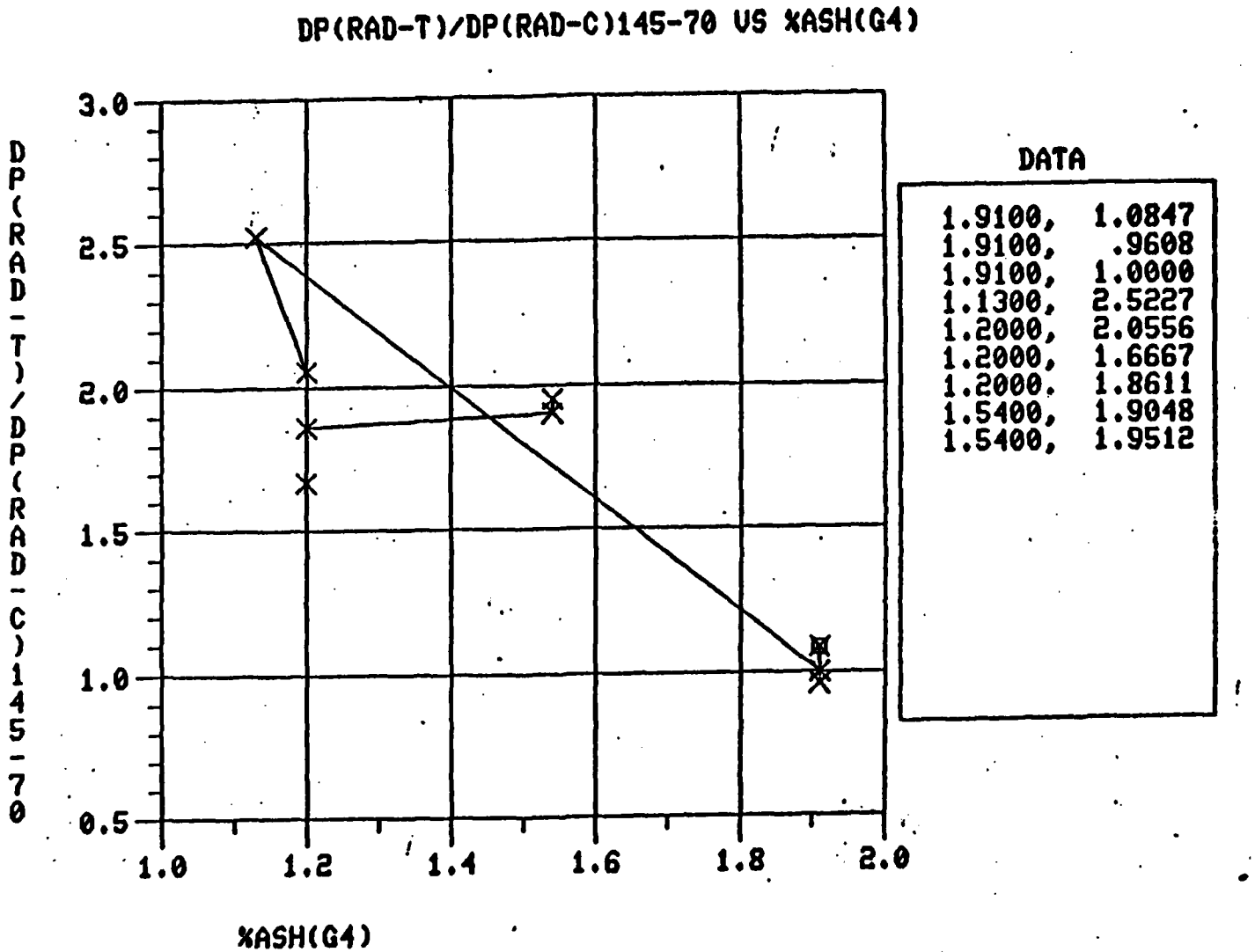

DP(RAD-T)/DP(RAD-C)145-70 VS %ASH(G4)
DP(RAD-T)/DP(RAD-C)145-70
3.0
2.5
2.0
1.5
1.0
0.5
1.0
1.2
1.4
1.6
1.8
2.0
%ASH(G4)
DATA
1.9100, 1.0847
1.9100, .9608
1.9100, 1.0000
1.1300, 2.5227
1.2000, 2.0556
1.2000, 1.6667
1.2000, 1.8611
1.5400, 1.9048
1.5400, 1.9512

Fig. 20

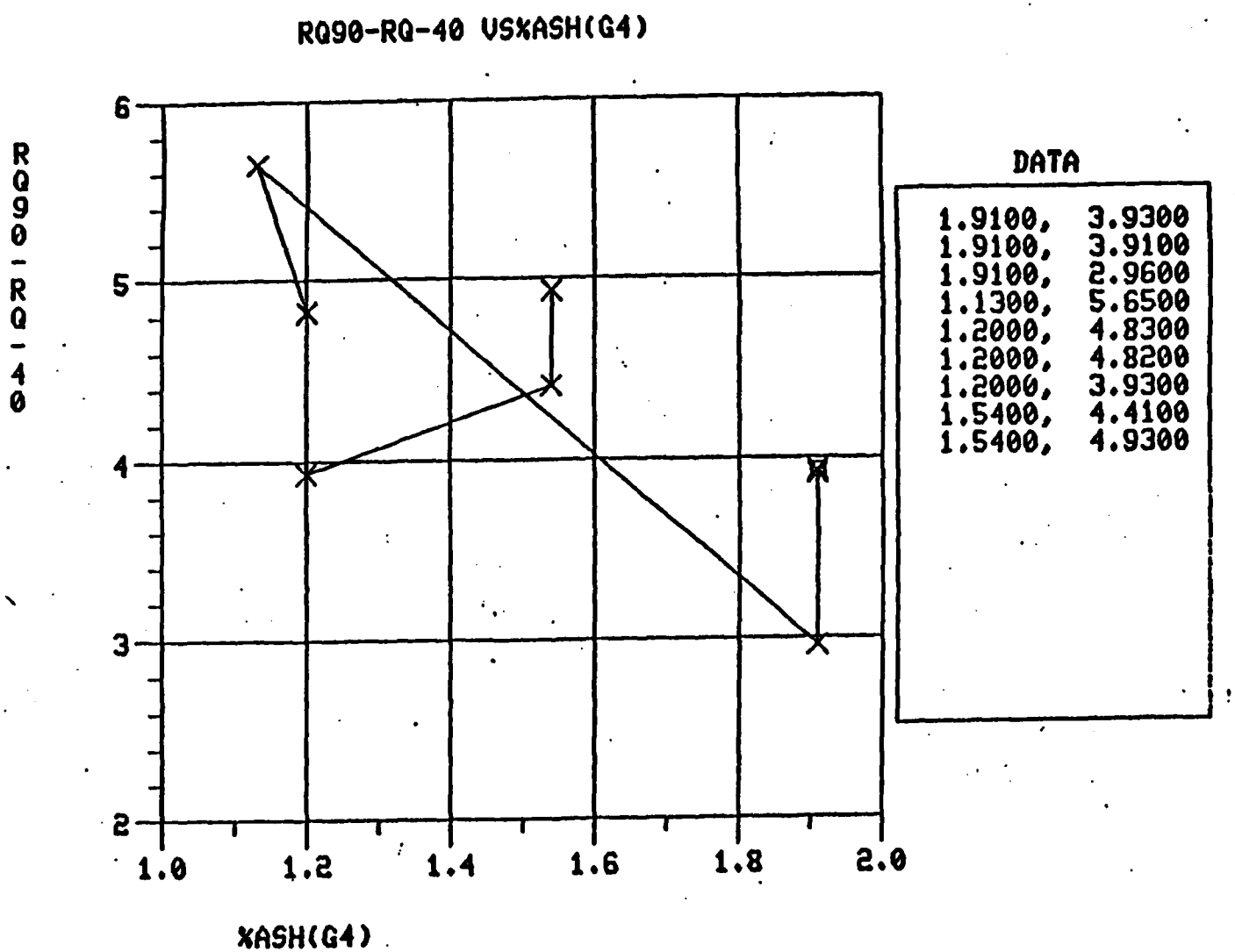

RQ90-RQ-40 VS%ASH(G4)
RQ90-RQ-40
6
5
4
3
2
1.0
1.2
1.4
1.6
1.8
2.0
%ASH(G4)
DATA
1.9100, 3.9300
1.9100, 3.9100
1.9100, 2.9600
1.1300, 5.6500
1.2000, 4.8300
1.2000, 4.8200
1.2000, 3.9300
1.5400, 4.4100
1.5400, 4.9300

Fig. 21

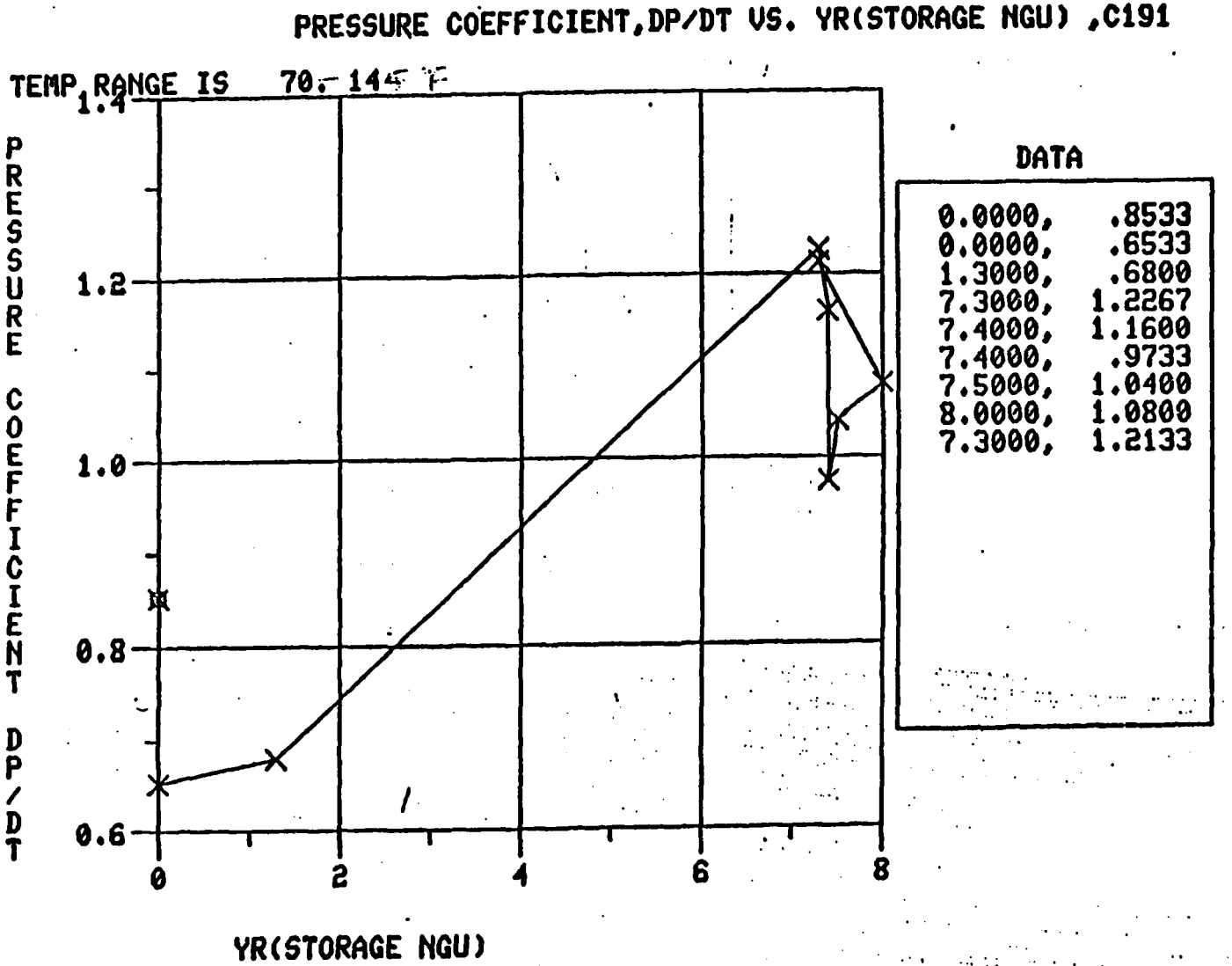

PRESSURE COEFFICIENT,DP/DT VS. YR(STORAGE NGU) ,C191
TEMP RANGE IS 70. 145 F
PRESSURE COEFFICIENT DP/DT
1.4
1.2
1.0
0.8
0.6
0
2
4
6
8
YR(STORAGE NGU)
DATA
0.0000, .8533
0.0000, .6533
1.3000, .6800
7.3000, 1.2267
7.4000, 1.1600
7.4000, .9733
7.5000, 1.0400
8.0000, 1.0800
7.3000, 1.2133

Fig. 32

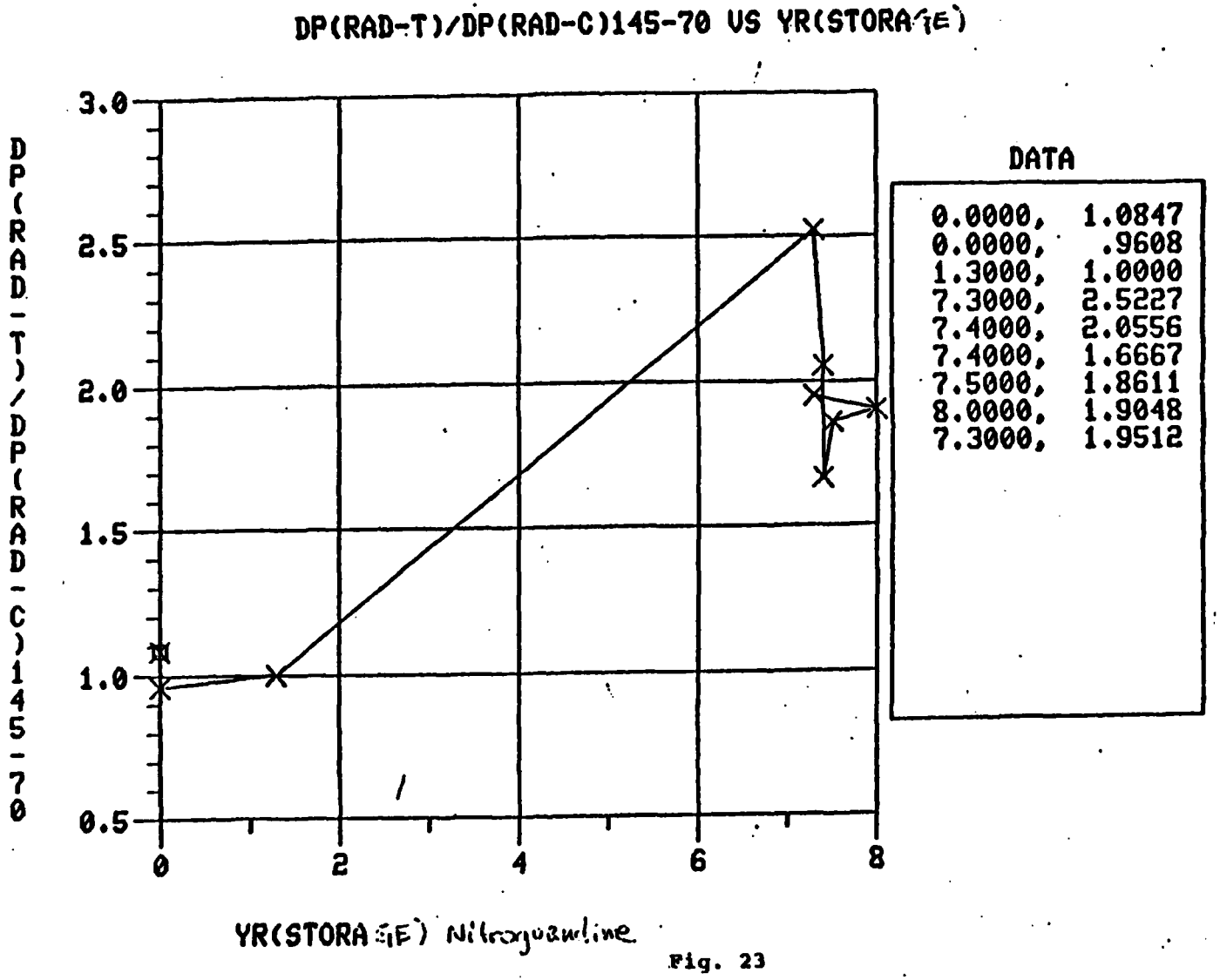

DP(RAD-T)/DP(RAD-C)145-70 VS YR(STORAGE)
DP(RAD-T)/DP(RAD-C)145-70
3.0
2.5
2.0
1.5
1.0
0.5
0
2
4
6
8
YR(STORAGE) Nitrogen line
DATA
0.0000, 1.0847
0.0000, .9608
1.3000, 1.0000
7.3000, 2.5227
7.4000, 2.0556
7.4000, 1.6667
7.5000, 1.8611
8.0000, 1.9048
7.3000, 1.9512

Fig. 23

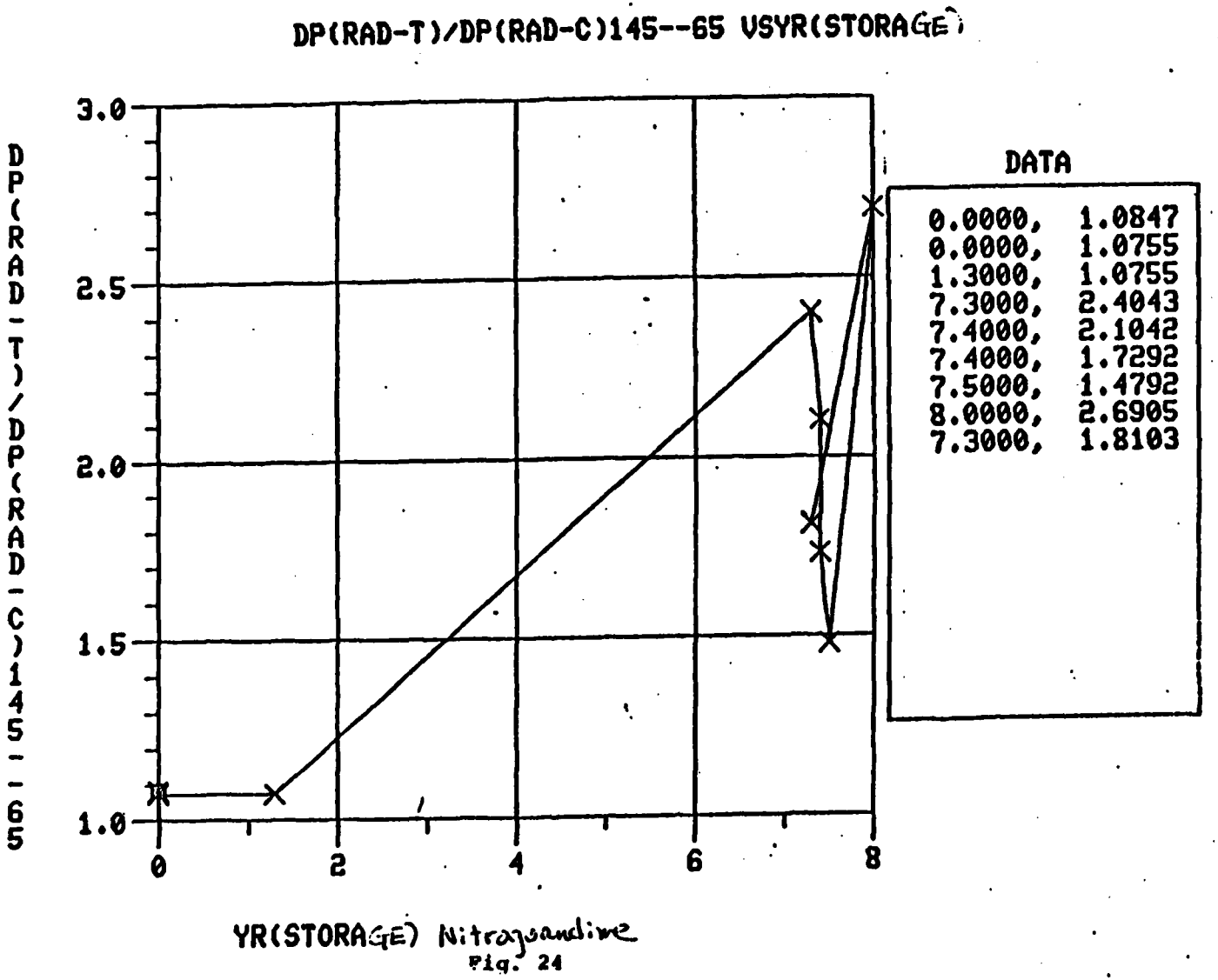

DP(RAD-T)/DP(RAD-C)145--65 VSYR(STORAGE)
DP(RAD-T)/DP(RAD-C)145--65
3.0
2.5
2.0
1.5
1.0
0
2
4
6
8
YR(STORAGE) Nitrogsandive
DATA
0.0000, 1.0847
0.0000, 1.0755
1.3000, 1.0755
7.3000, 2.4043
7.4000, 2.1042
7.4000, 1.7292
7.5000, 1.4792
8.0000, 2.6905
7.3000, 1.8103

Fig. 24

B. Summary of weak or slight trend Plots

Fig #	Independent Variable	Vs.	Dependent Variable
25	% N_2 in Nitrocellulose		Pressure at 145 °F
26	Viscosity		DP/DT_2 (70 -145)°F
27-30	Freeness (Nitrocellulose)		Pressure at 70°F
			DP/DT_2(70 -145)°F
			$\frac{DP(TEST)}{DP(CALI)}/DT_2$ (70 -145)°F
			RQ90 - (RQ -40)
31-34	PH Value (Nitroguanidine)		DP/DT_2 (70 -145)°F
			$\frac{DP(TEST)}{DP(CALI)}/DT_2$ (70 -145)°F
			$\frac{DP(TEST)}{DP(CALI)}/DT_1$(65 -145)°F
			RQ90 - (RQ -40)
35-38	% Ethyl Centralite (% Composition)		DP/DT_2(70 -145)°F
			$\frac{DP(TEST)}{DP(CALI)}/DT_2$ (70 -145)°F
			$\frac{DP(TEST)}{DP(CALI)}/DT_1$ (-65 -145)°F
			RQ90 - (RQ -40)
39-44	Volatile Content (in Ethyl Centralite		RQ90 - RQ -40
			Pressure at 70°F
			Pressure at 145°F
			DP/DT_2 (70 -145)°F
			$\frac{DP(TEST)}{DP(CALI)}/DT_1$ (-65 -145)°F
			$\frac{DP(TEST)}{DP(CALI)}/DT_2$(70 -145°F
45-48	% Moisture (in Potassium Sulfate)		Pressure at -65°F
			Pressure at 70°F
			Pressure at 145)°F
			DP/DT_1 (-65 -145)°F
49-50	% Nitroglycerine (% Composition)		Pressure at -65
			DP/DT_3 (-65 -70)°F

51	Length of Grain	Pressure at 145°F
52	Perforation Diameter	Pressure at -65°F
53	D/d	DP/DT_2 (70 -145)°F
54-57	Length uniformity of grain	RQ90-RQ -40 Pressure at 70°F DP/DT_2 (70 -145)°F $\frac{DP(TEST)}{DP(CAL)}/DT_2$(70 -145)°F
58-61	Diameter uniformity of grain	Pressure at 145°F DP/DT_2 (70 -145)°F RQ90-RQ -40 $\frac{DP(TEST)}{DP(CALI)}/DT_2$ (70 -145)°F
62-63	Yr (Storage) Nitroguanidine	Pressure at 145°F RQ90-(RQ -40)

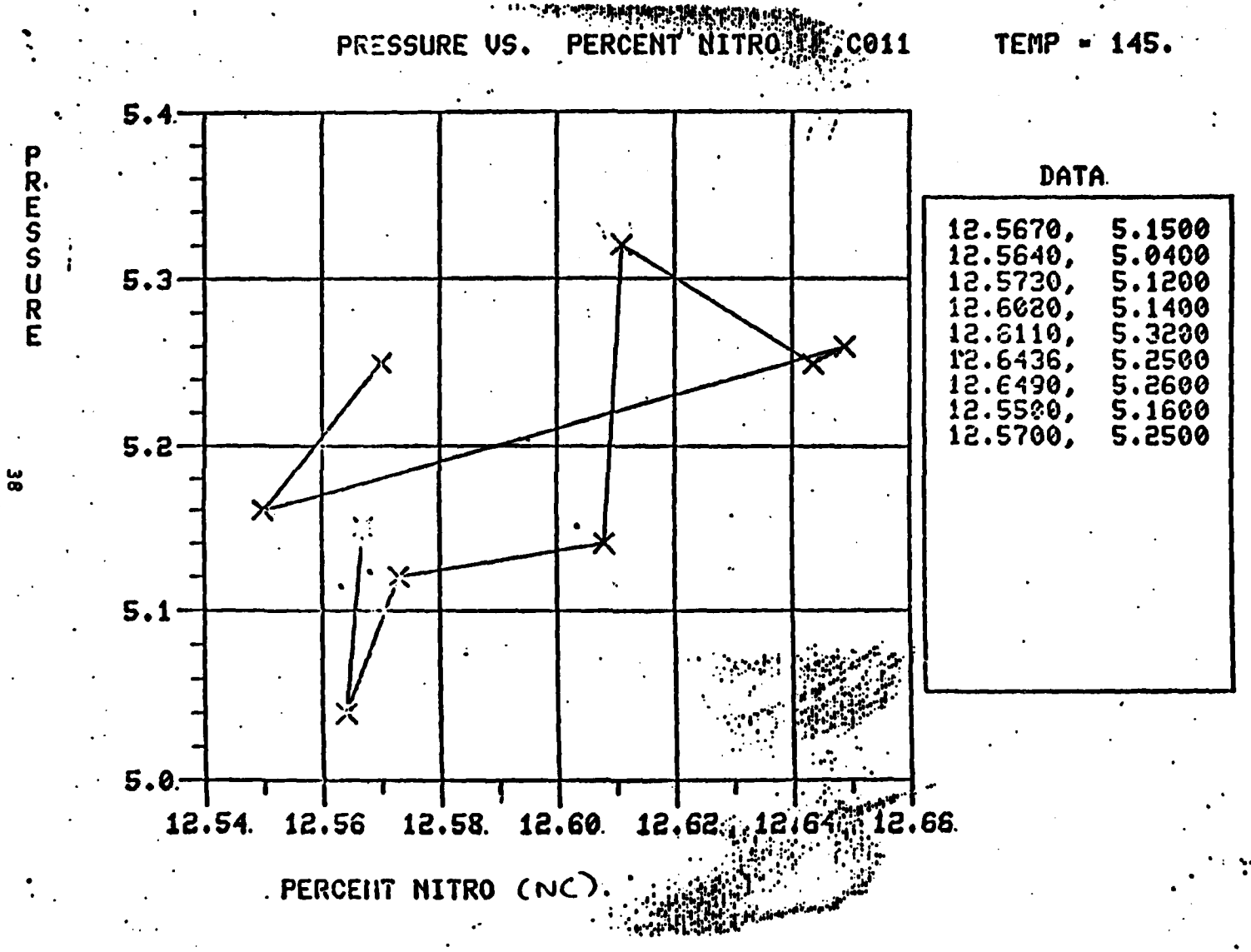

PRESSURE VS. PERCENT NITRO IF,C011 TEMP = 145.
PRESSURE
5.4
5.3
5.2
5.1
5.0
12.54
12.56
12.58
12.60
12.62
12.64
12.66
PERCENT NITRO (NC).
DATA
12.5670, 5.1500
12.5640, 5.0400
12.5730, 5.1200
12.6020, 5.1400
12.6110, 5.3200
12.6436, 5.2500
12.6490, 5.2600
12.5500, 5.1600
12.5700, 5.2500

Fig. 25

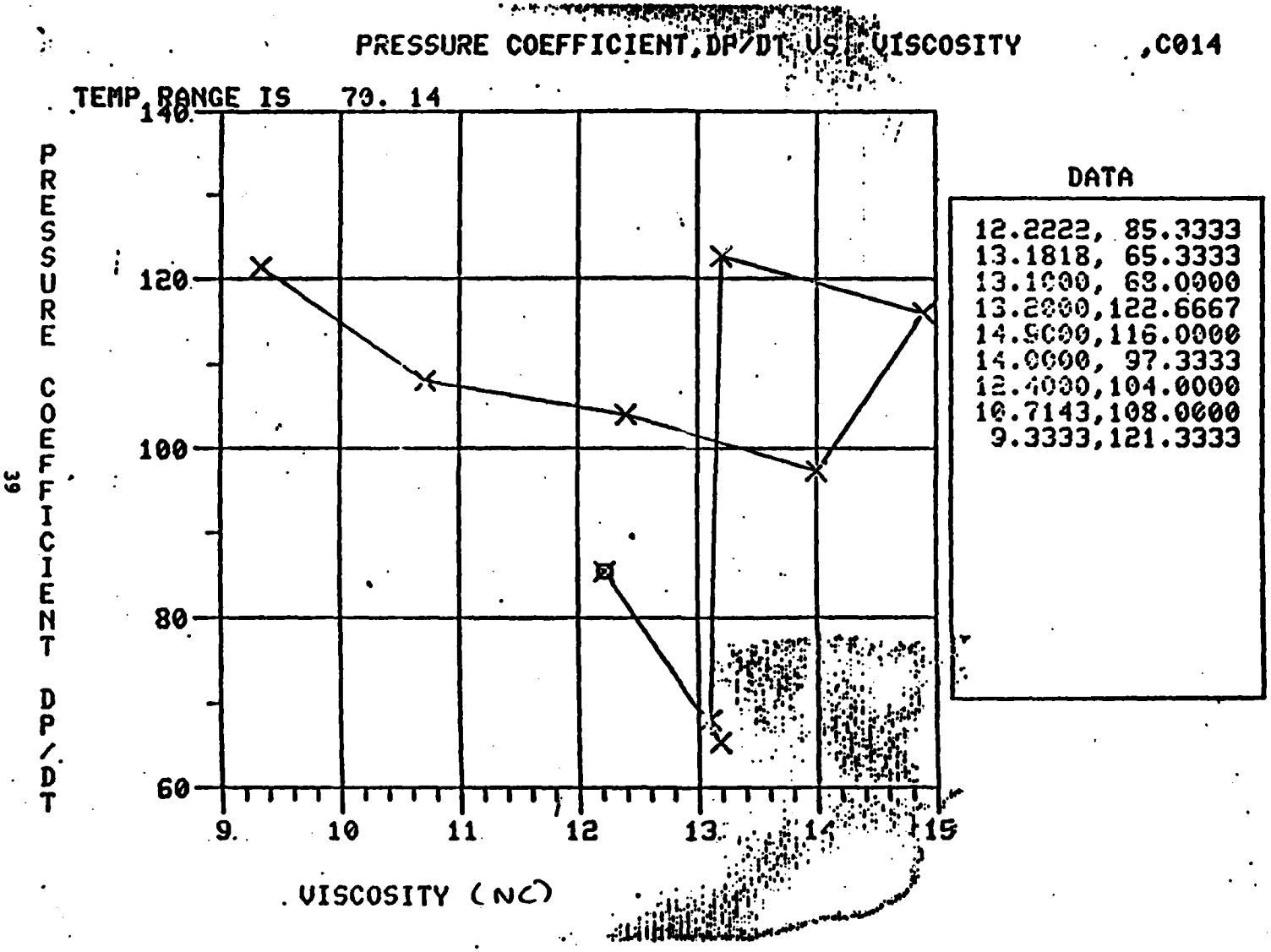

PRESSURE COEFFICIENT,DP/DT VS. VISCOSITY ,C014
TEMP RANGE IS 73. 14
PRESSURE COEFFICIENT DP/DT
140
120
100
80
60
9.
10
11
12
13
14
15
VISCOSITY (NC)
DATA
12.2222, 85.3333
13.1818, 65.3333
13.1000, 68.0000
13.2000,122.6667
14.5000,116.0000
14.0000, 97.3333
12.4000,104.0000
10.7143,108.0000
9.3333,121.3333

Fig. 26

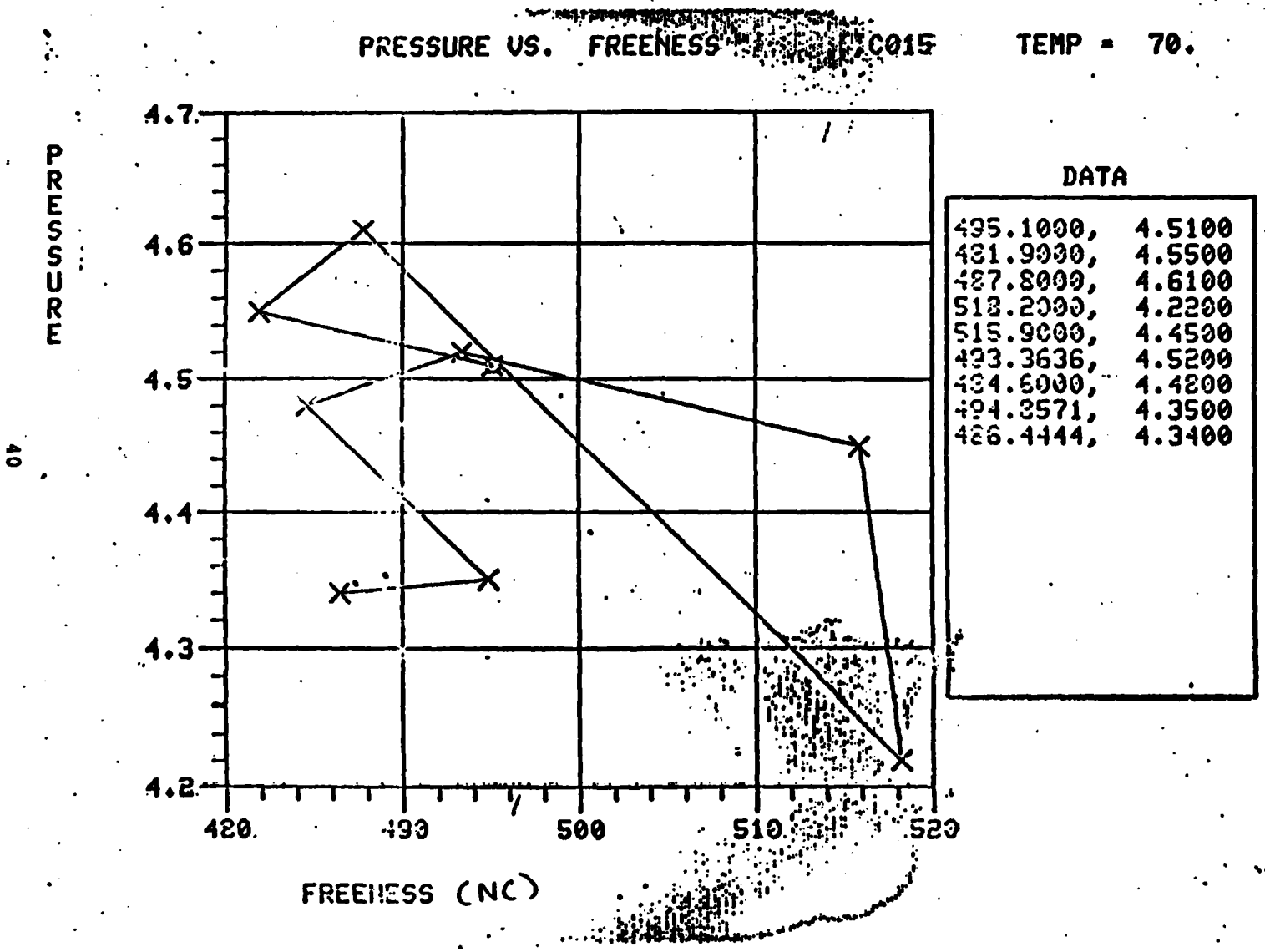

PRESSURE VS. FREENESS C015 TEMP = 70.
PRESSURE
4.7
4.6
4.5
4.4
4.3
4.2
420.
490
500
510
520
FREENESS (NC)
DATA
495.1000, 4.5100
481.9000, 4.5500
487.8000, 4.6100
513.2000, 4.2200
515.9000, 4.4500
493.3636, 4.5200
484.6000, 4.4200
494.3571, 4.3500
486.4444, 4.3400

Fig. 27

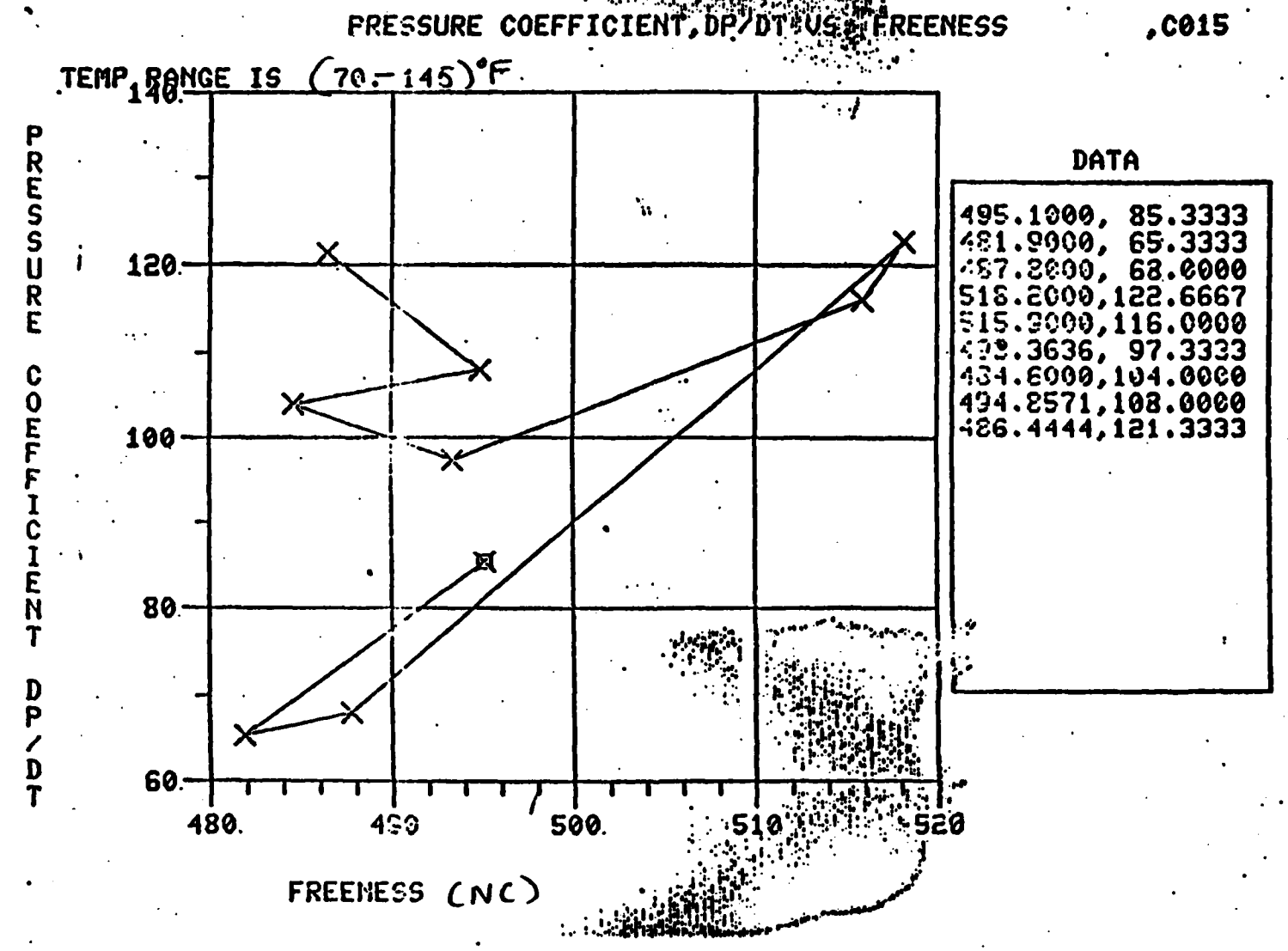

PRESSURE COEFFICIENT, DP/DT VS. FREENESS ,C015
TEMP RANGE IS (70.-145)°F
PRESSURE COEFFICIENT DP/DT
140.
120.
100.
80.
60.
480.
490
500.
510
520
FREENESS (NC)
DATA
495.1000, 85.3333
481.9000, 65.3333
487.2000, 68.0000
516.2000,122.6667
515.3000,116.0000
489.3636, 97.3333
494.6000,104.0000
494.8571,108.0000
486.4444,121.3333

Fig. 23

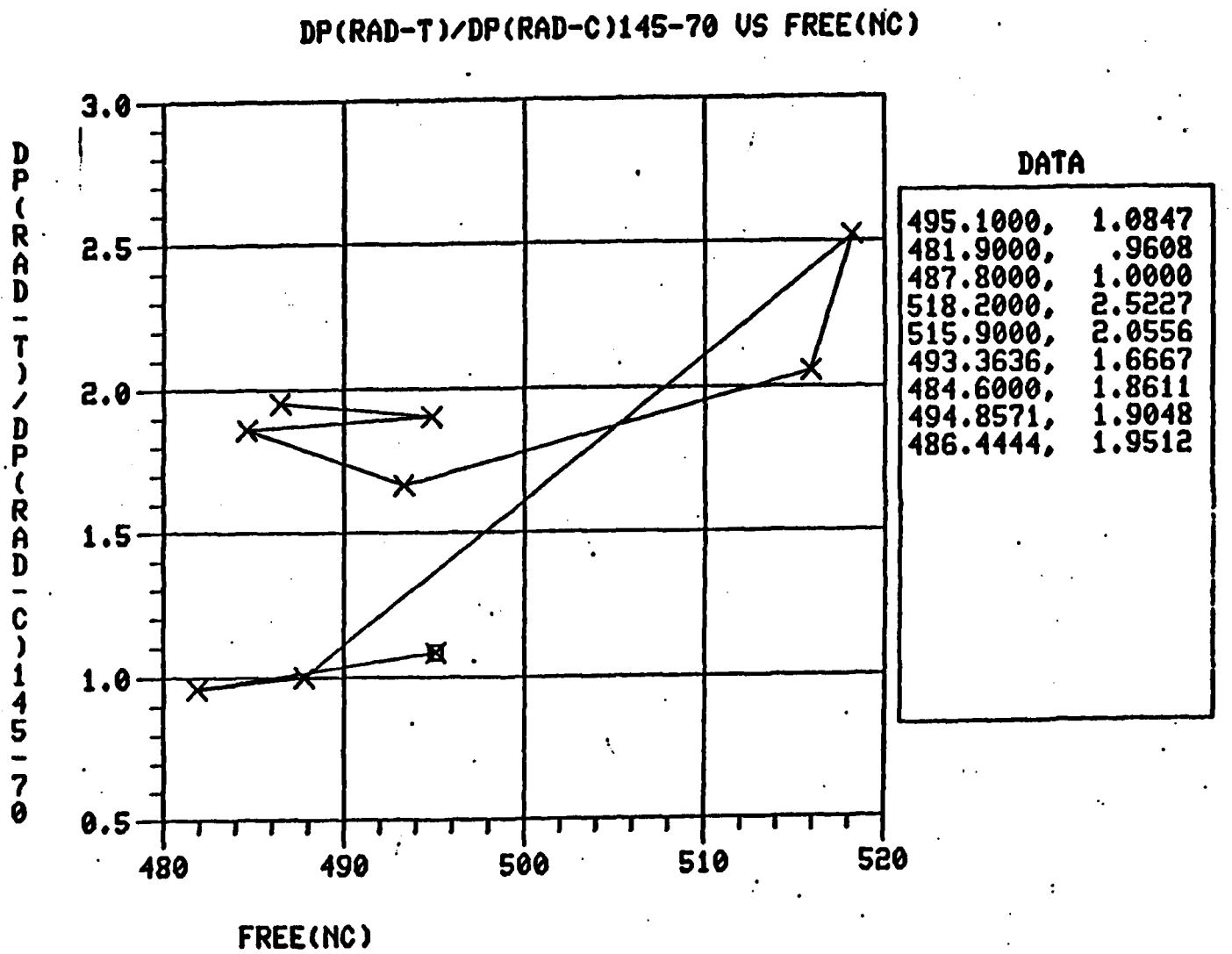

DP(RAD-T)/DP(RAD-C)145-70 VS FREE(NC)
DP(RAD-T)/DP(RAD-C)145-70
3.0
2.5
2.0
1.5
1.0
0.5
480
490
500
510
520
FREE(NC)
DATA
495.1000, 1.0847
481.9000, .9608
487.8000, 1.0000
518.2000, 2.5227
515.9000, 2.0556
493.3636, 1.6667
484.6000, 1.8611
494.8571, 1.9048
486.4444, 1.9512

Fig. 29

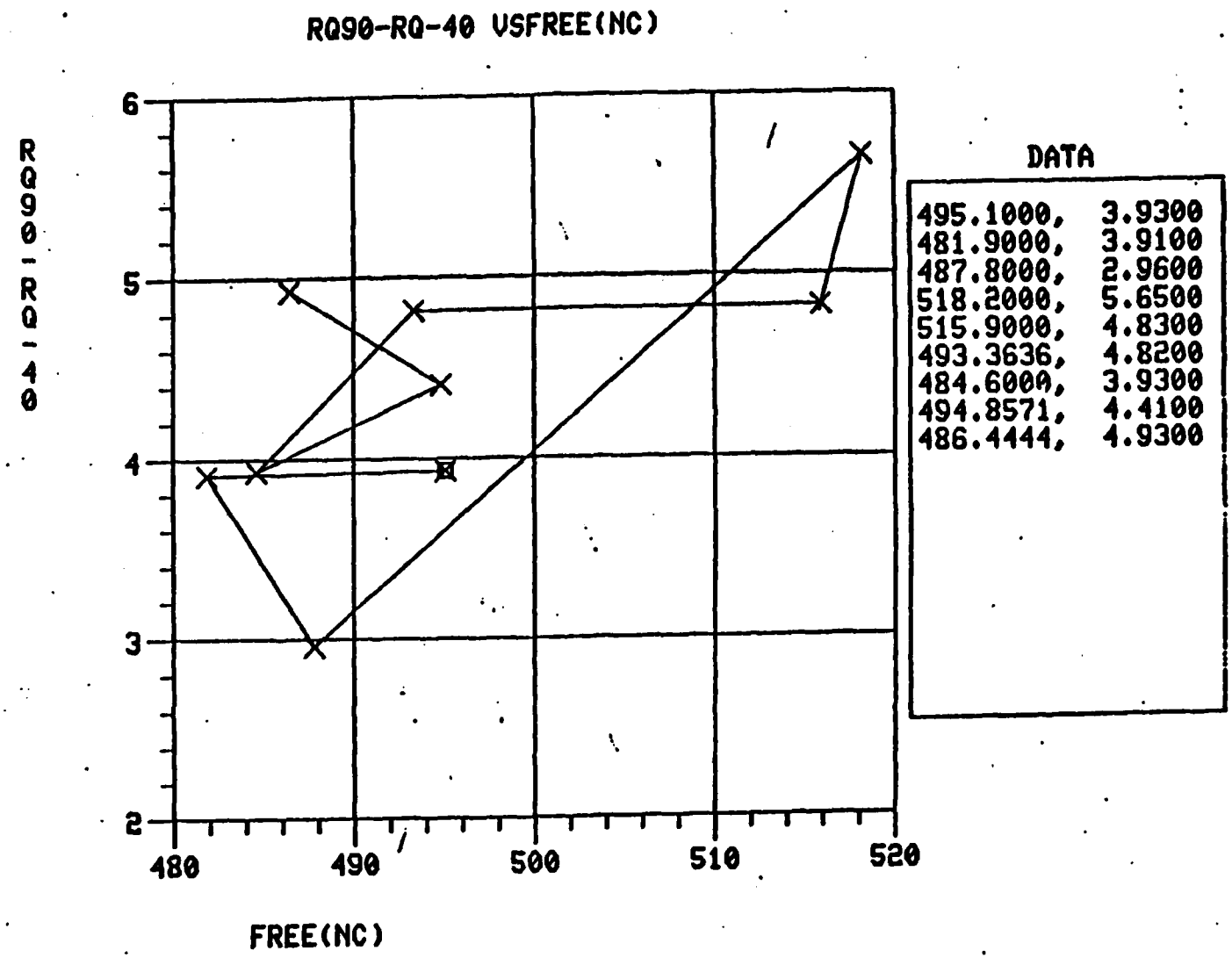

RQ90-RQ-40 VSFREE(NC)
RQ90-RQ-40
6
5
4
3
2
480
490
500
510
520
FREE(NC)
DATA
495.1000, 3.9300
481.9000, 3.9100
487.8000, 2.9600
518.2000, 5.6500
515.9000, 4.8300
493.3636, 4.8200
484.6000, 3.9300
494.8571, 4.4100
486.4444, 4.9300

Fig. 30

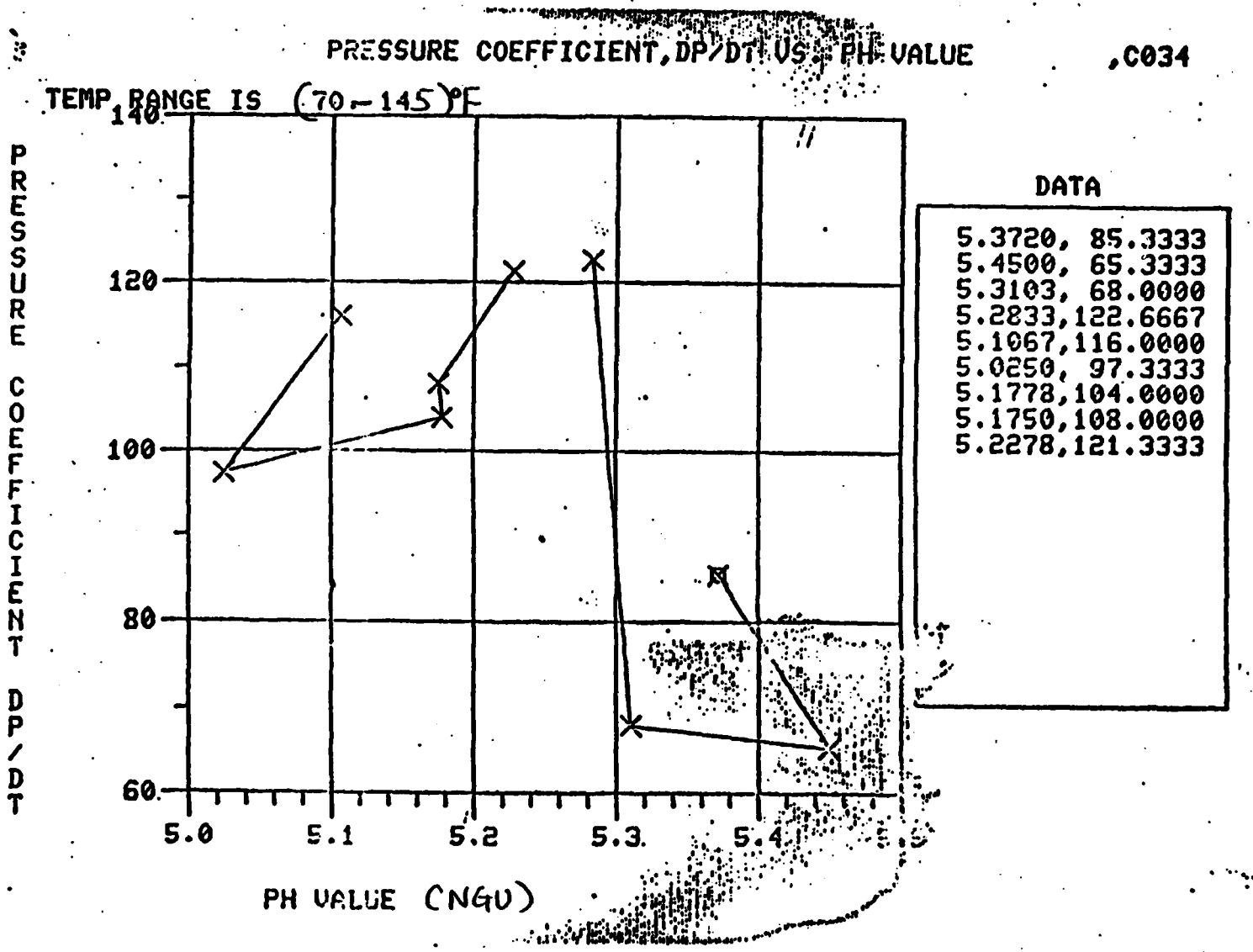

PRESSURE COEFFICIENT, DP/DT VS. PH VALUE
,C034
TEMP. RANGE IS (70-145)°F
PRESSURE COEFFICIENT DP/DT
140
120
100
80
60
5.0
5.1
5.2
5.3
5.4
PH VALUE (NGU)
DATA
5.3720, 85.3333
5.4500, 65.3333
5.3103, 68.0000
5.2833,122.6667
5.1067,116.0000
5.0250, 97.3333
5.1778,104.0000
5.1750,108.0000
5.2278,121.3333

Fig. 31

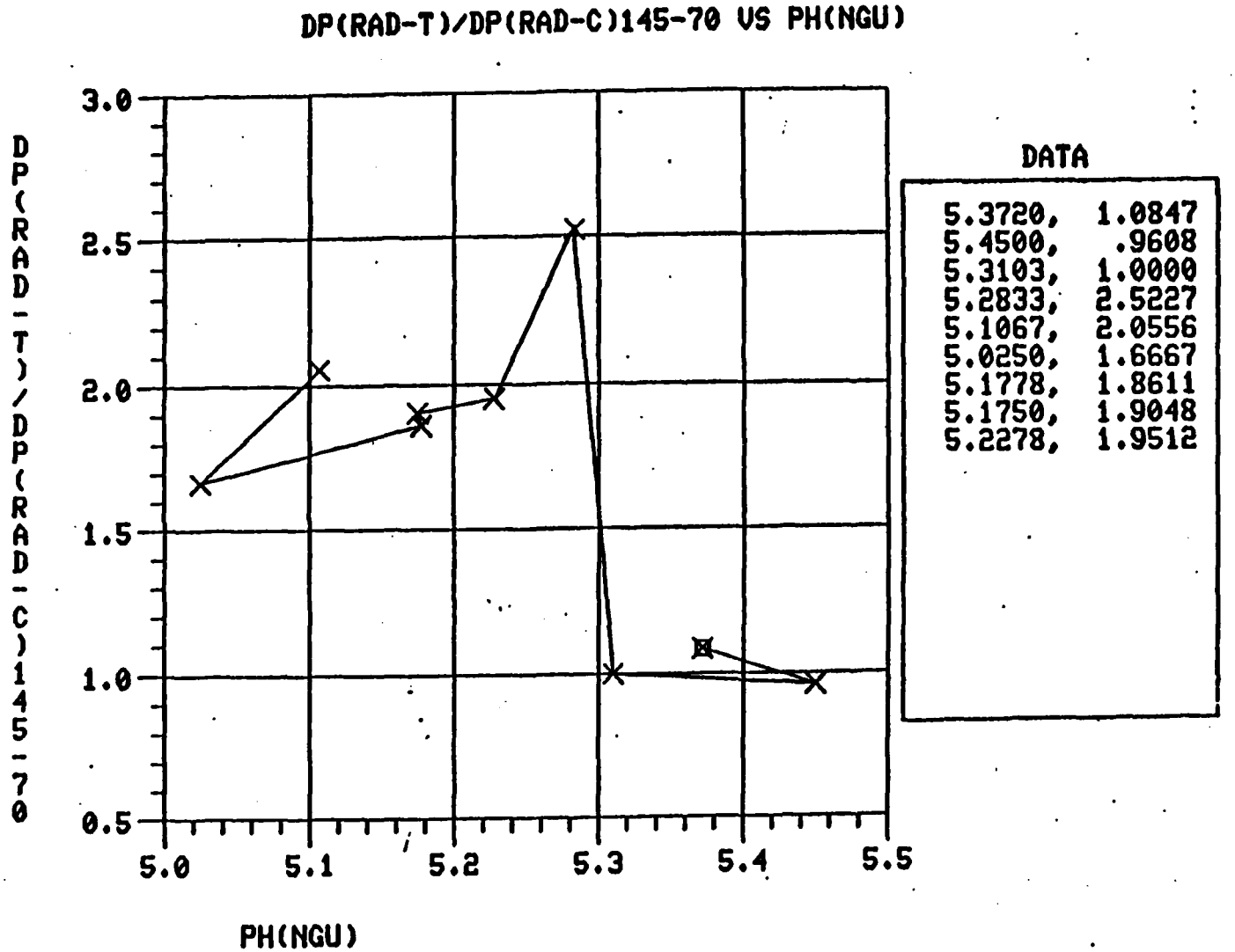

DP(RAD-T)/DP(RAD-C)145-70 VS PH(NGU)
DP(RAD-T)/DP(RAD-C)145-70
3.0
2.5
2.0
1.5
1.0
0.5
5.0
5.1
5.2
5.3
5.4
5.5
PH(NGU)
DATA
5.3720, 1.0847
5.4500, .9608
5.3103, 1.0000
5.2833, 2.5227
5.1067, 2.0556
5.0250, 1.6667
5.1778, 1.8611
5.1750, 1.9048
5.2278, 1.9512

Fig. 32

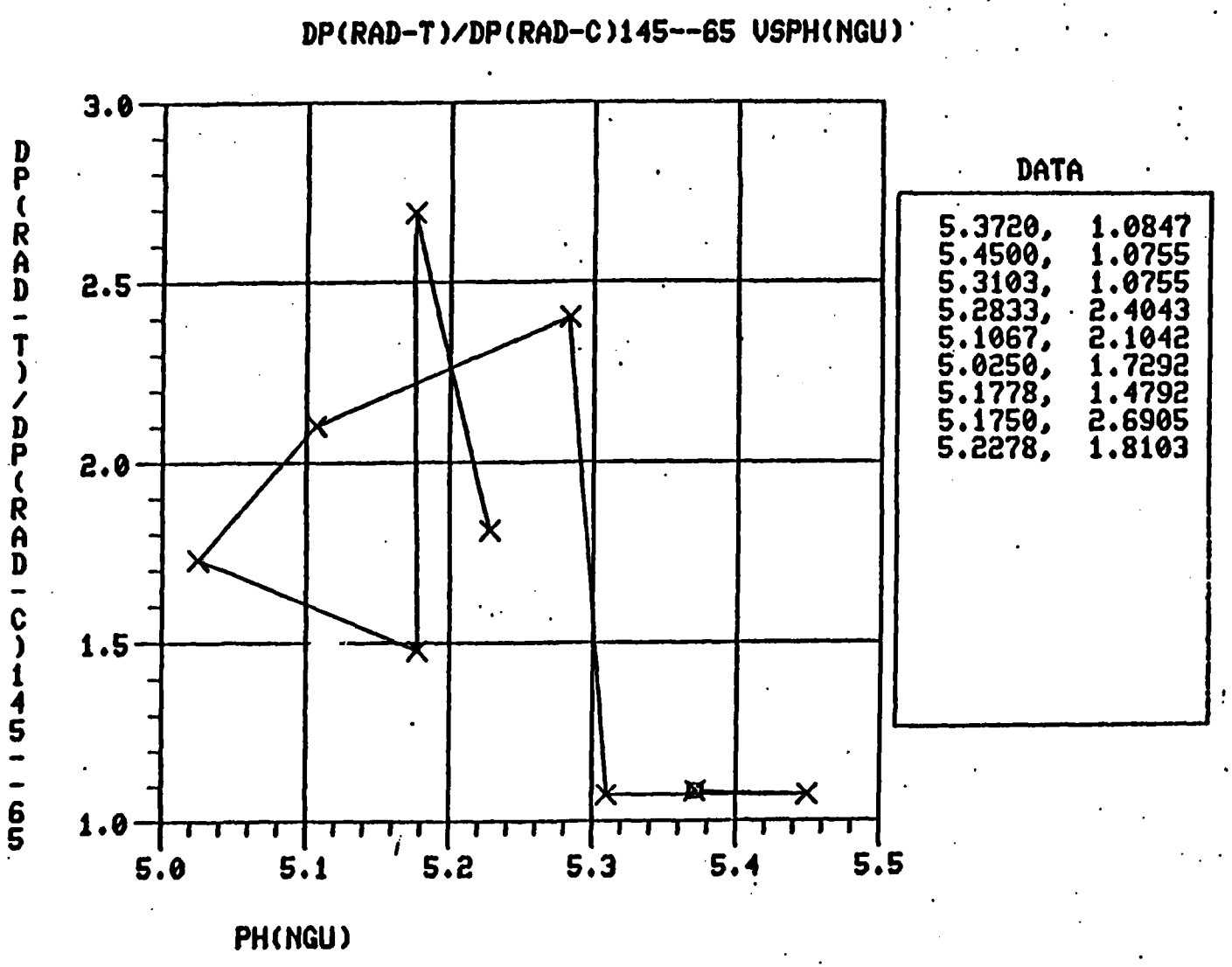

DP(RAD-T)/DP(RAD-C)145--65 VSPH(NGU)
DP(RAD-T)/DP(RAD-C)145--65
3.0
2.5
2.0
1.5
1.0
5.0
5.1
5.2
5.3
5.4
5.5
PH(NGU)
DATA
5.3720, 1.0847
5.4500, 1.0755
5.3103, 1.0755
5.2833, 2.4043
5.1067, 2.1042
5.0250, 1.7292
5.1778, 1.4792
5.1750, 2.6905
5.2278, 1.8103

Fig. 33

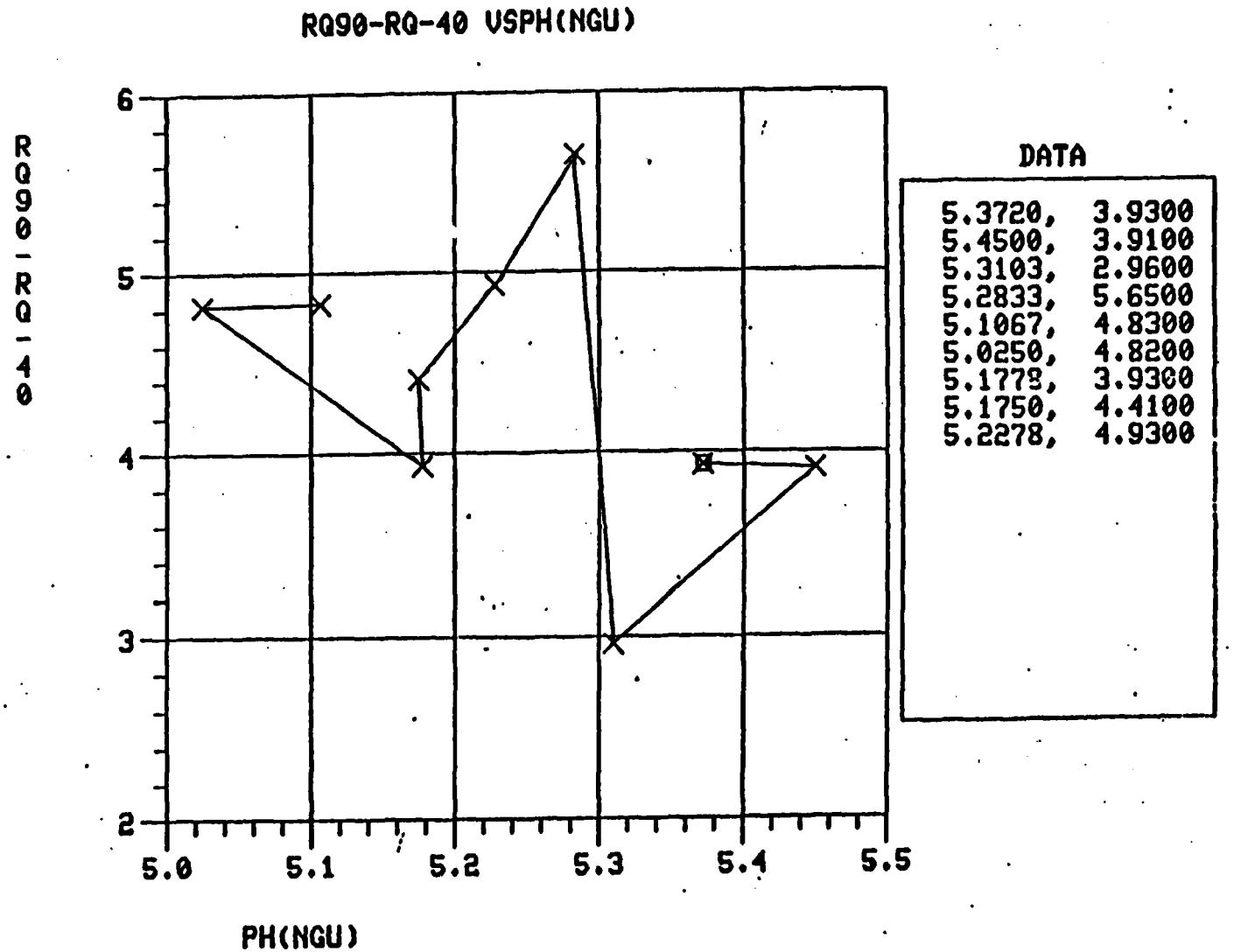

RQ90-RQ-40 VSPH(NGU)
RQ90-RQ-40
6
5
4
3
2
5.0
5.1
5.2
5.3
5.4
5.5
PH(NGU)
DATA
5.3720, 3.9300
5.4500, 3.9100
5.3103, 2.9600
5.2833, 5.6500
5.1067, 4.8300
5.0250, 4.8200
5.1778, 3.9300
5.1750, 4.4100
5.2278, 4.9300

Fig. 34

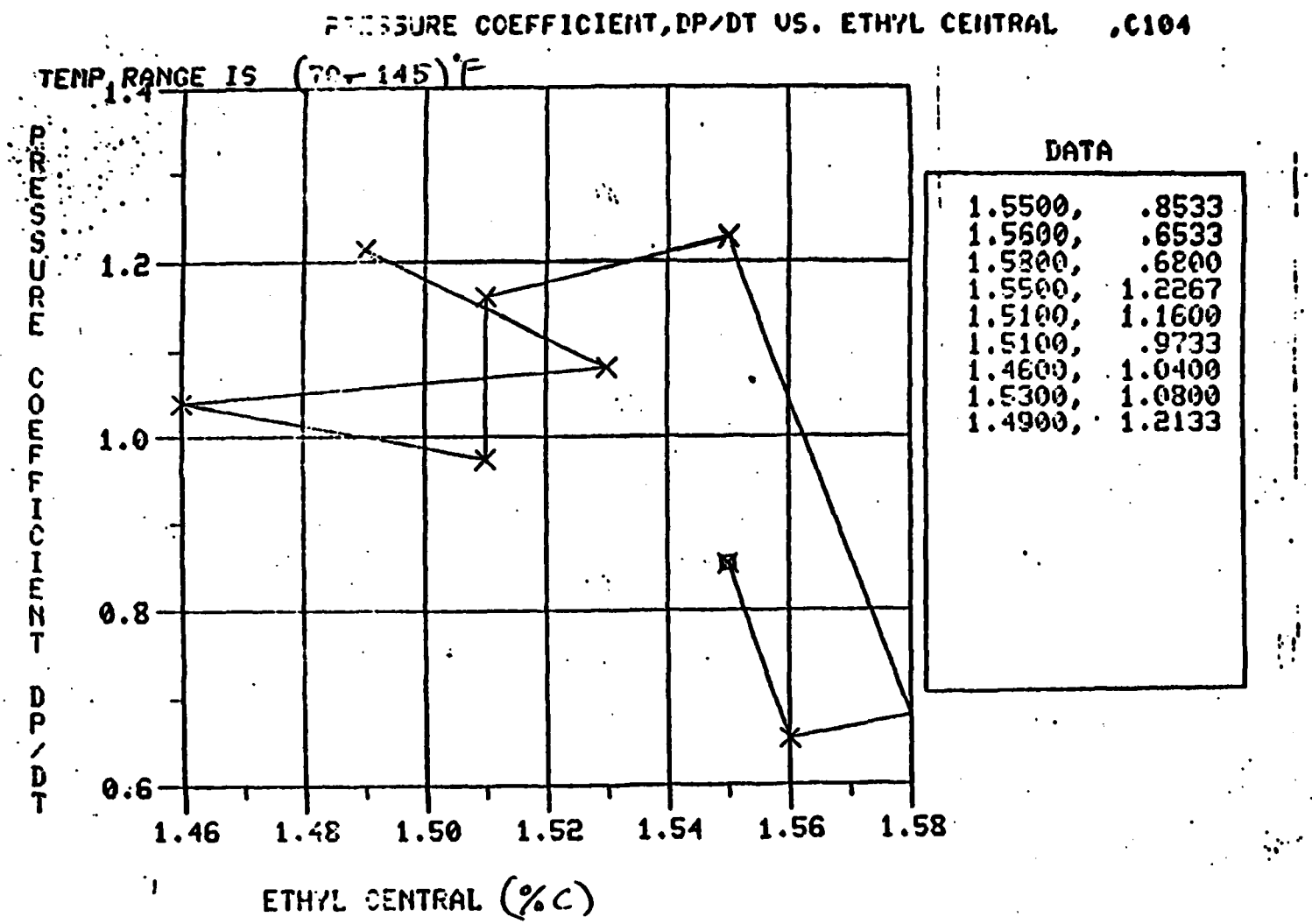

PRESSURE COEFFICIENT,DP/DT VS. ETHYL CENTRAL ,C104
TEMP RANGE IS (70-145)°F
PRESSURE COEFFICIENT DP/DT
1.4
1.2
1.0
0.8
0.6
1.46
1.48
1.50
1.52
1.54
1.56
1.58
ETHYL CENTRAL (%C)
DATA
1.5500, .8533
1.5600, .6533
1.5800, .6800
1.5500, 1.2267
1.5100, 1.1600
1.5100, .9733
1.4600, 1.0400
1.5300, 1.0800
1.4900, 1.2133

Fig. 35

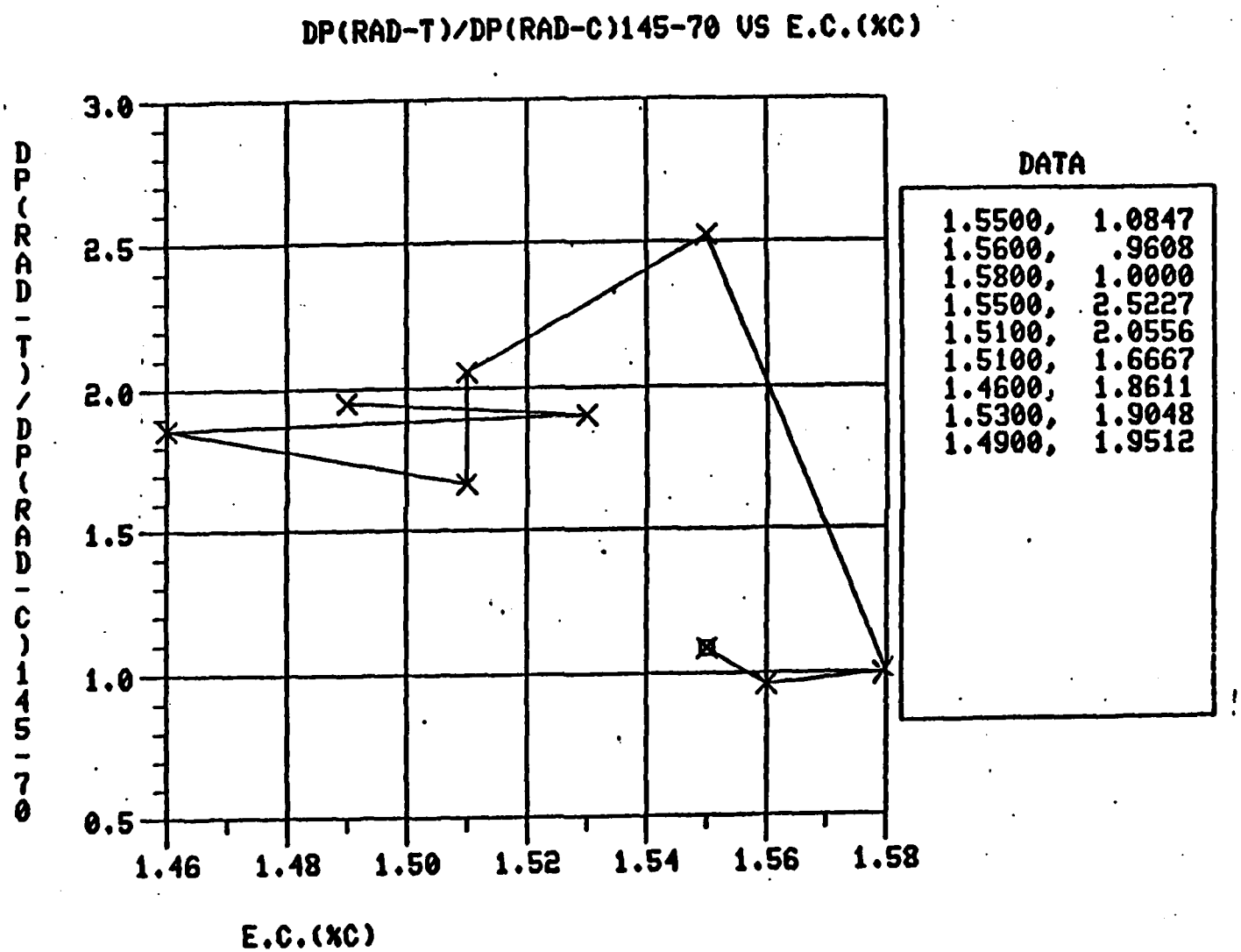

DP(RAD-T)/DP(RAD-C)145-70 VS E.C.(%C)
DP(RAD-T)/DP(RAD-C)145-70
3.0
2.5
2.0
1.5
1.0
0.5
1.46
1.48
1.50
1.52
1.54
1.56
1.58
E.C.(%C)
DATA
1.5500, 1.0847
1.5600, .9608
1.5800, 1.0000
1.5500, 2.5227
1.5100, 2.0556
1.5100, 1.6667
1.4600, 1.8611
1.5300, 1.9048
1.4900, 1.9512

Fig. 36

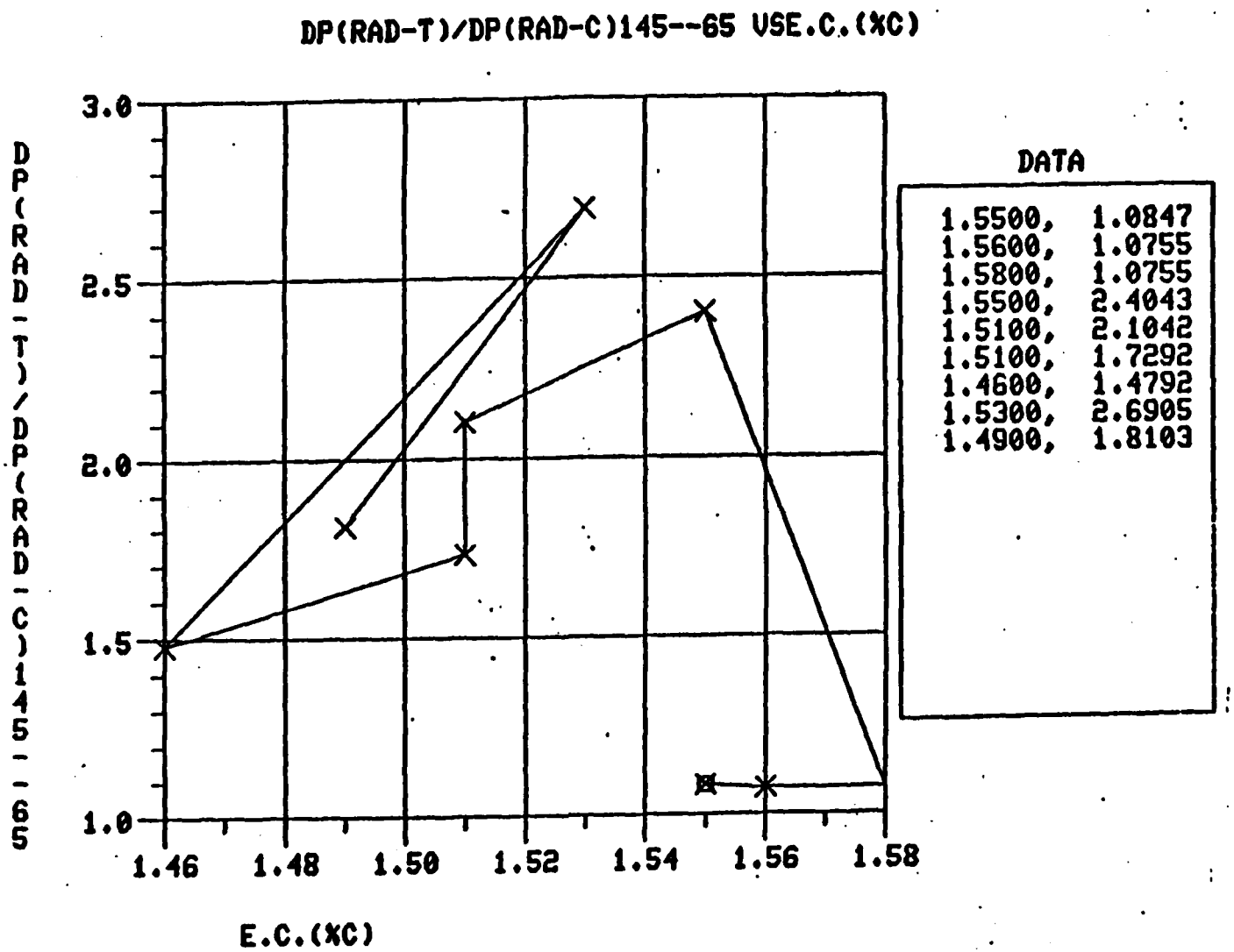

DP(RAD-T)/DP(RAD-C)145--65 VSE.C.(%C)
DP(RAD-T)/DP(RAD-C)145--65
3.0
2.5
2.0
1.5
1.0
1.46
1.48
1.50
1.52
1.54
1.56
1.58
E.C.(%C)
DATA
1.5500, 1.0847
1.5600, 1.0755
1.5800, 1.0755
1.5500, 2.4043
1.5100, 2.1042
1.5100, 1.7292
1.4600, 1.4792
1.5300, 2.6905
1.4900, 1.8103

Fig. 37

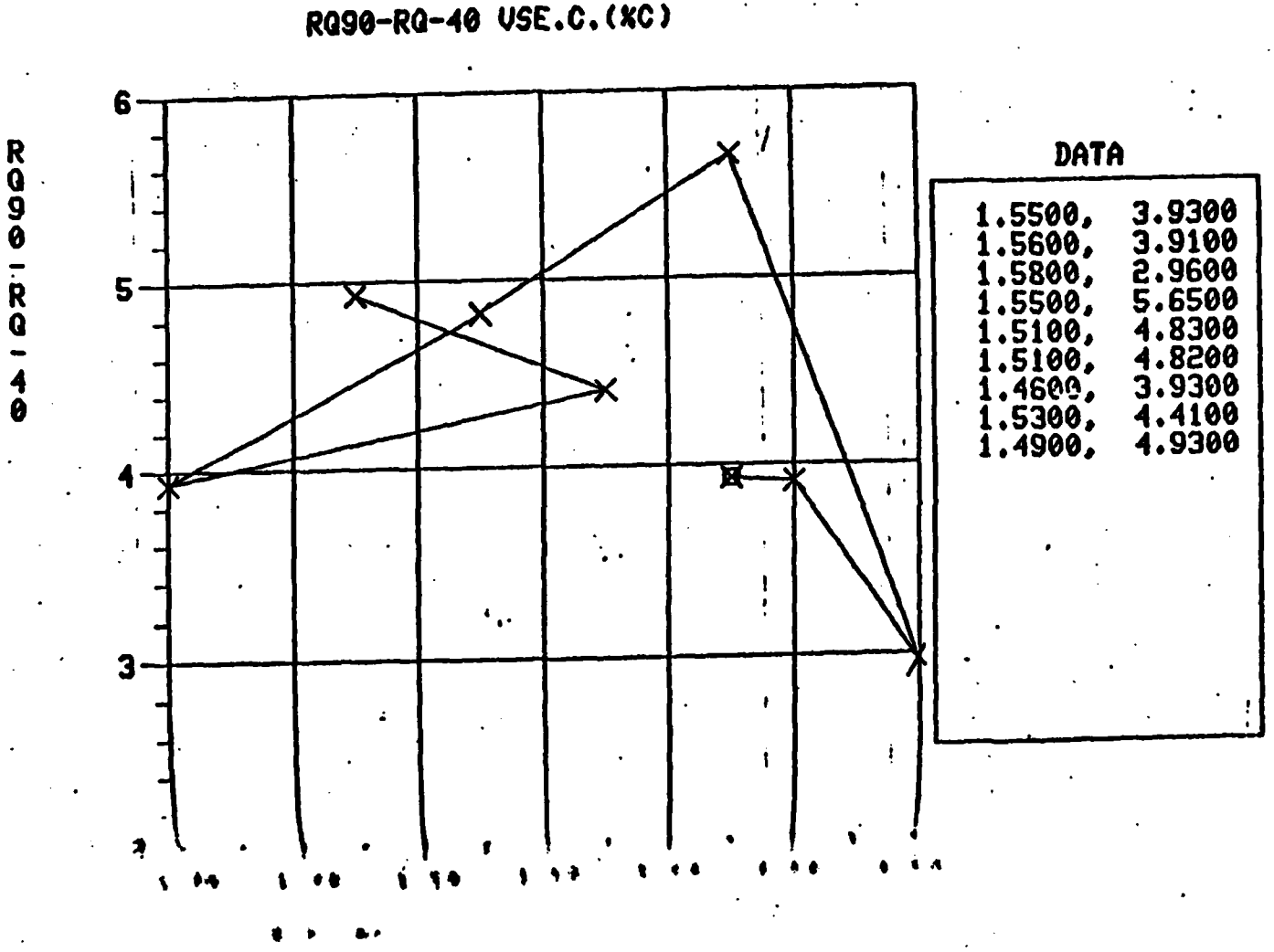

RQ90-RQ-40 USE.C.(XC)
RQ90-RQ-40
6
5
4
3
DATA
1.5500, 3.9300
1.5600, 3.9100
1.5800, 2.9600
1.5500, 5.6500
1.5100, 4.8300
1.5100, 4.8200
1.4600, 3.9300
1.5300, 4.4100
1.4900, 4.9300

Fig. 38

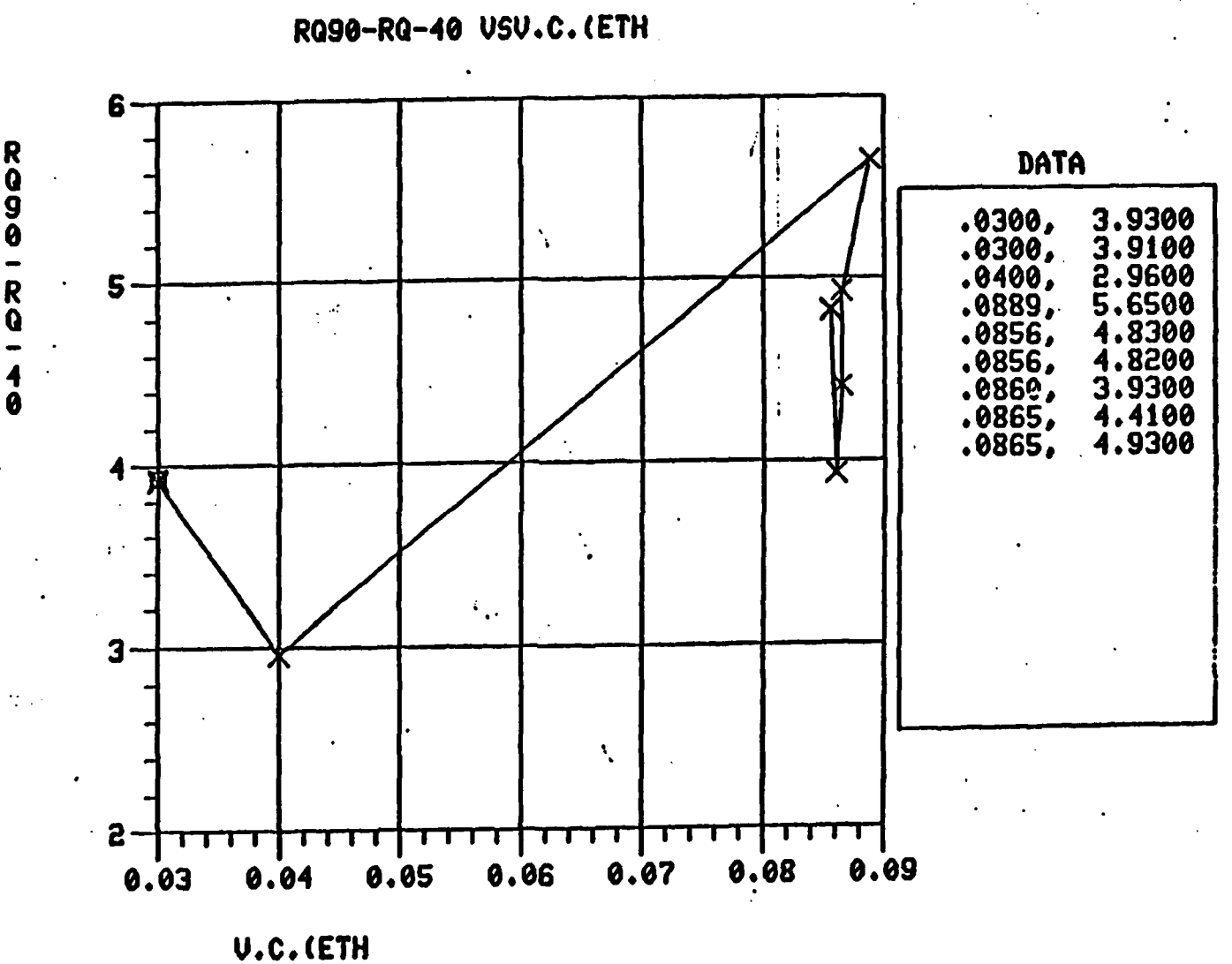

RQ90-RQ-40 VSV.C.(ETH
RQ90-RQ-40
6
5
4
3
2
0.03
0.04
0.05
0.06
0.07
0.08
0.09
V.C.(ETH
DATA
.0300, 3.9300
.0300, 3.9100
.0400, 2.9600
.0889, 5.6500
.0856, 4.8300
.0856, 4.8200
.0860, 3.9300
.0865, 4.4100
.0865, 4.9300

Fig. 39

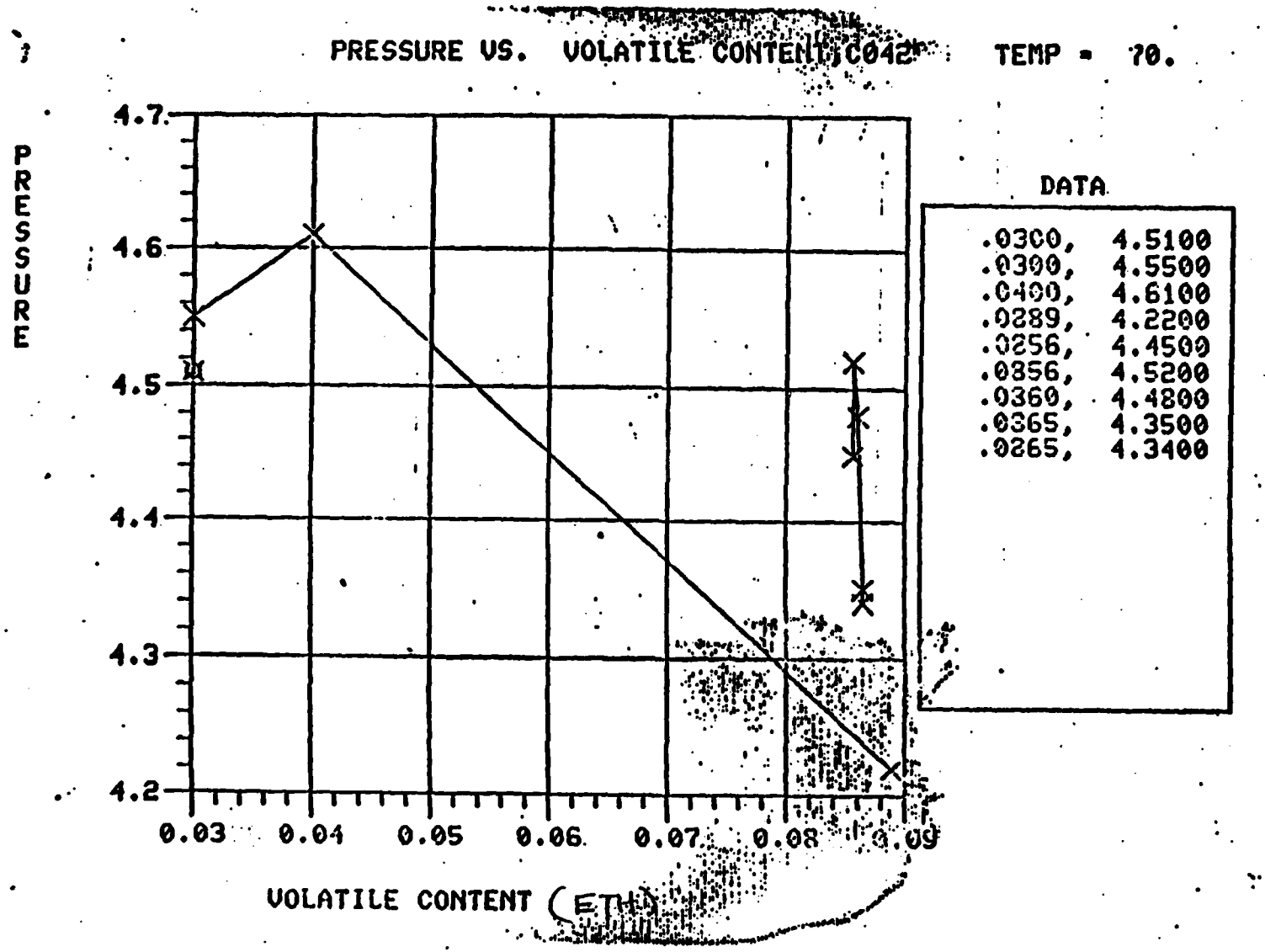

PRESSURE VS. VOLATILE CONTENT (C042)
TEMP = 70.
PRESSURE
4.7
4.6
4.5
4.4
4.3
4.2
0.03
0.04
0.05
0.06
0.07
0.08
0.09
VOLATILE CONTENT (ETH)
DATA
.0300, 4.5100
.0300, 4.5500
.0400, 4.6100
.0289, 4.2200
.0256, 4.4500
.0356, 4.5200
.0360, 4.4800
.0365, 4.3500
.0265, 4.3400

Fig. 40

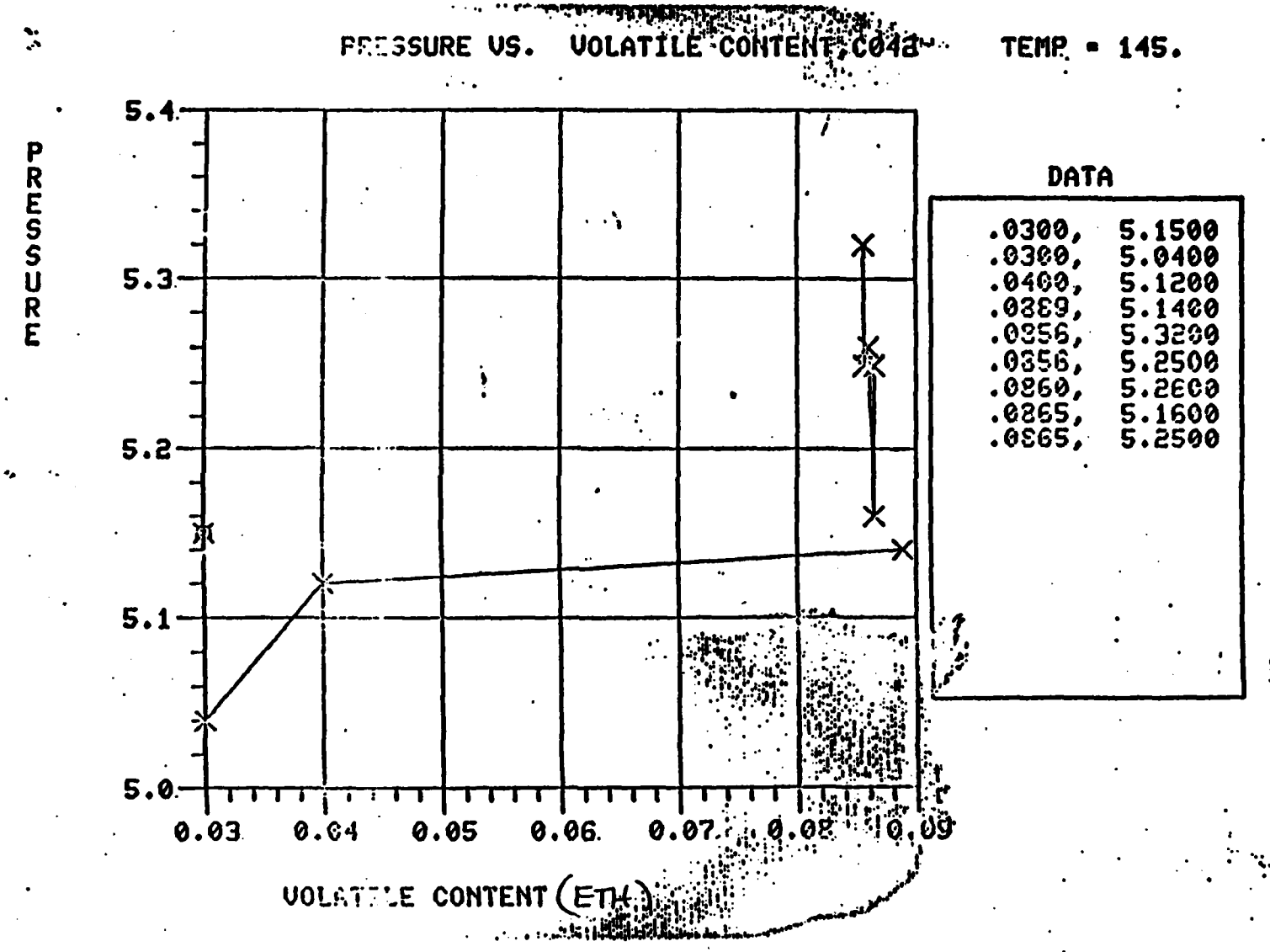

PRESSURE VS. VOLATILE CONTENT,C04B TEMP. = 145.
PRESSURE
5.4
5.3
5.2
5.1
5.0
0.03
0.04
0.05
0.06
0.07
0.08
0.09
VOLATILE CONTENT (ETH)
DATA
.0300, 5.1500
.0300, 5.0400
.0400, 5.1200
.0389, 5.1400
.0356, 5.3200
.0356, 5.2500
.0360, 5.2600
.0365, 5.1600
.0365, 5.2500

Fig. 41

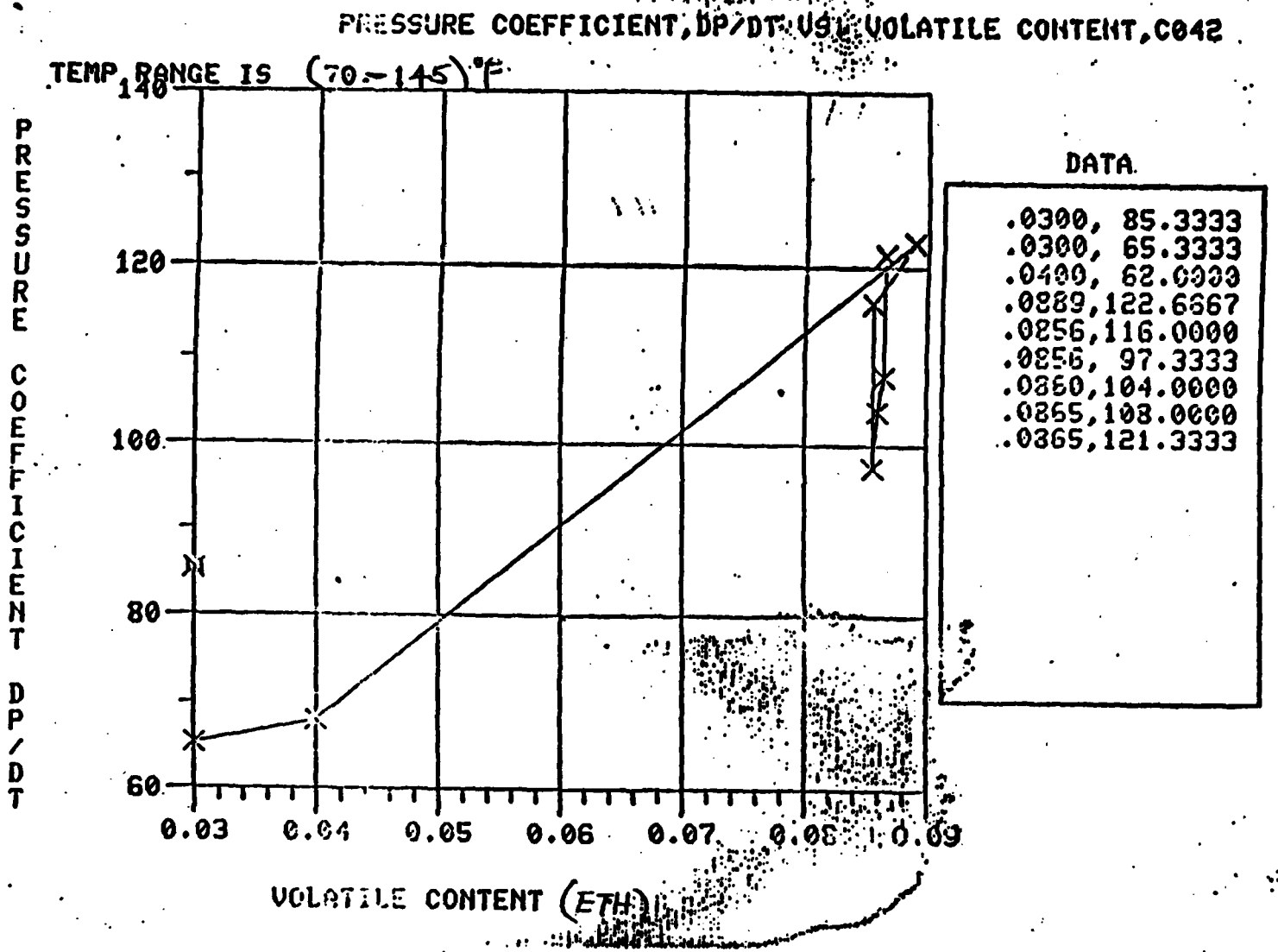

PRESSURE COEFFICIENT, DP/DT VS. VOLATILE CONTENT, C042
TEMP. RANGE IS (70-145)°F
PRESSURE COEFFICIENT DP/DT
140
120
100
80
60
0.03
0.04
0.05
0.06
0.07
0.08
0.09
VOLATILE CONTENT (ETH)
DATA
.0300, 85.3333
.0300, 65.3333
.0400, 62.0000
.0889,122.6667
.0856,116.0000
.0856, 97.3333
.0860,104.0000
.0865,108.0000
.0865,121.3333

Fig. 42

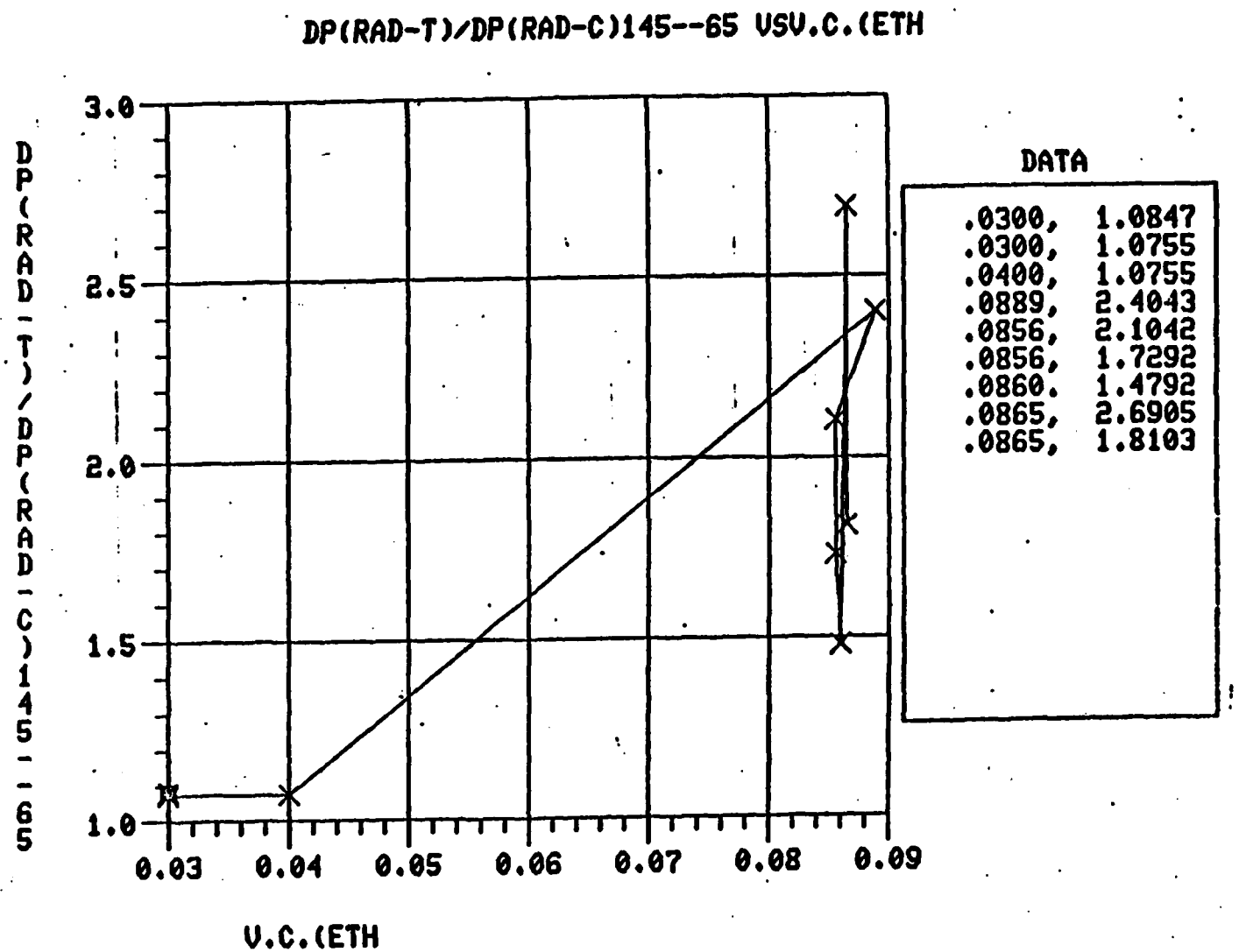

DP(RAD-T)/DP(RAD-C)145--65 VSV.C.(ETH
DP(RAD-T)/DP(RAD-C)145--65
3.0
2.5
2.0
1.5
1.0
0.03
0.04
0.05
0.06
0.07
0.08
0.09
V.C.(ETH
DATA
.0300, 1.0847
.0300, 1.0755
.0400, 1.0755
.0889, 2.4043
.0856, 2.1042
.0856, 1.7292
.0860, 1.4792
.0865, 2.6905
.0865, 1.8103

Fig. 43

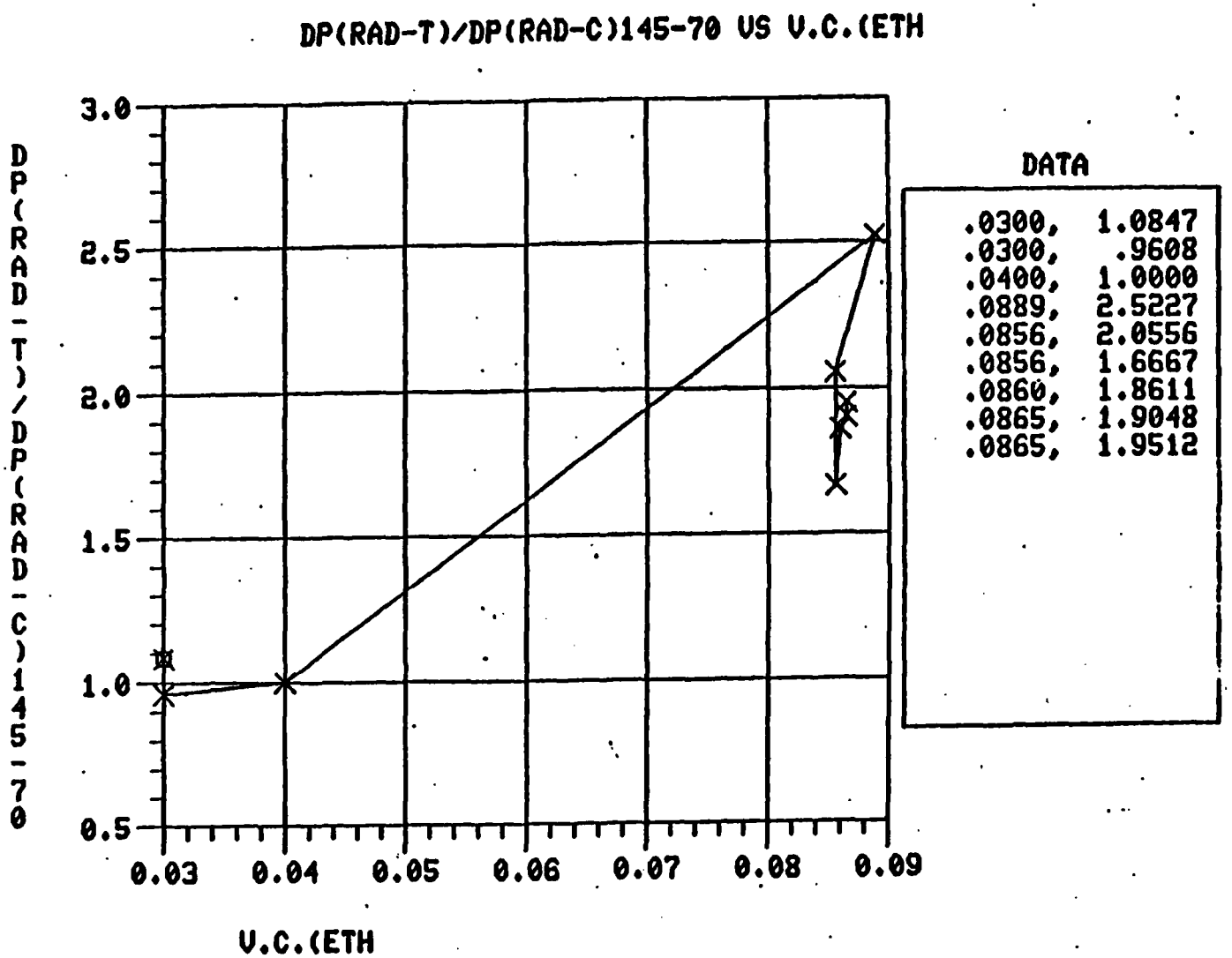

DP(RAD-T)/DP(RAD-C)145-70 US V.C.(ETH
DP(RAD-T)/DP(RAD-C)145-70
3.0
2.5
2.0
1.5
1.0
0.5
0.03
0.04
0.05
0.06
0.07
0.08
0.09
V.C.(ETH
DATA
.0300, 1.0847
.0300, .9608
.0400, 1.0000
.0889, 2.5227
.0856, 2.0556
.0856, 1.6667
.0860, 1.8611
.0865, 1.9048
.0865, 1.9512

Fig. 44

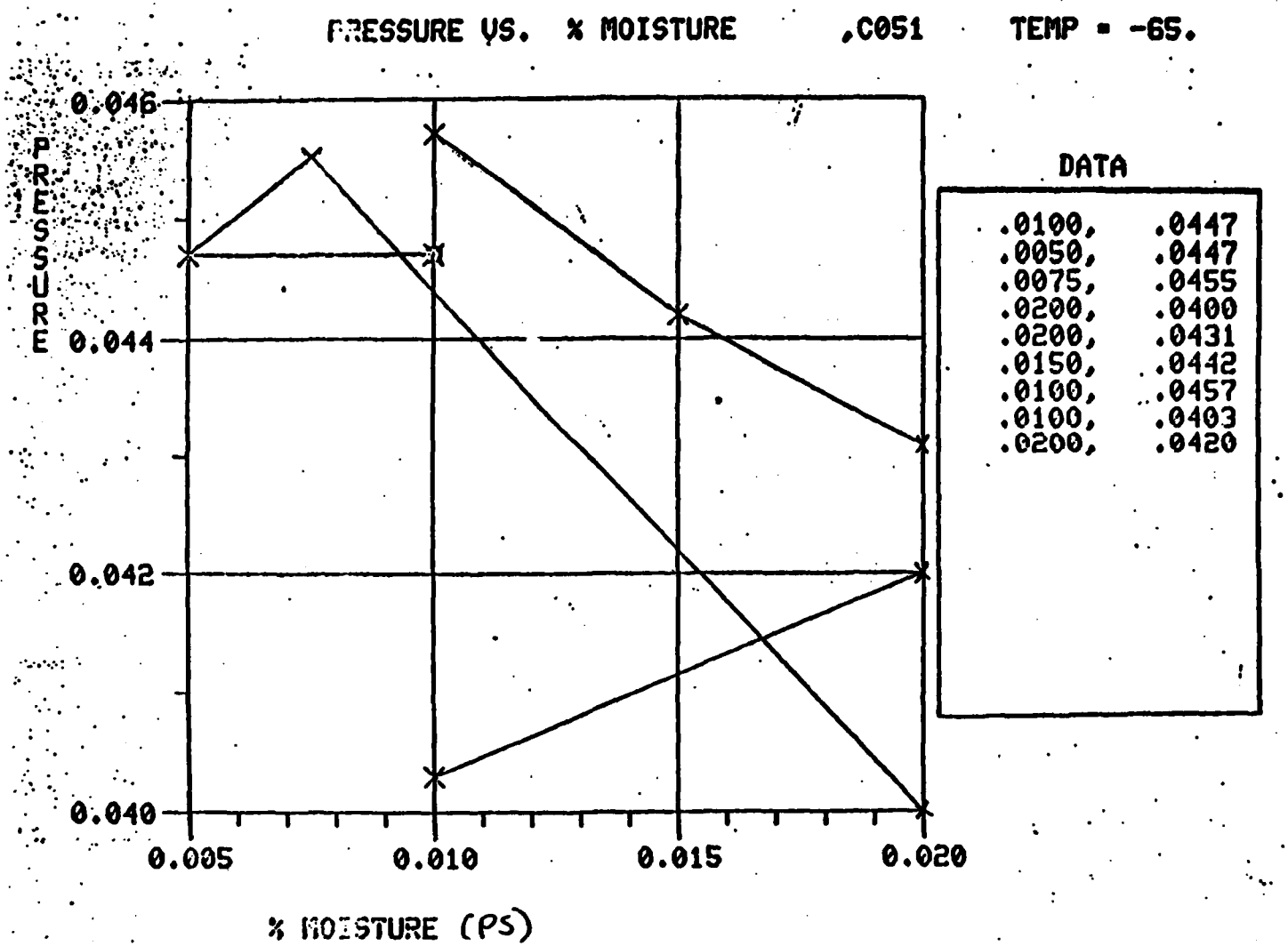

PRESSURE VS. % MOISTURE .C051 TEMP = -65.
PRESSURE
0.046
0.044
0.042
0.040
0.005
0.010
0.015
0.020
% MOISTURE (PS)
DATA
.0100, .0447
.0050, .0447
.0075, .0455
.0200, .0400
.0200, .0431
.0150, .0442
.0100, .0457
.0100, .0403
.0200, .0420

Fig. 45

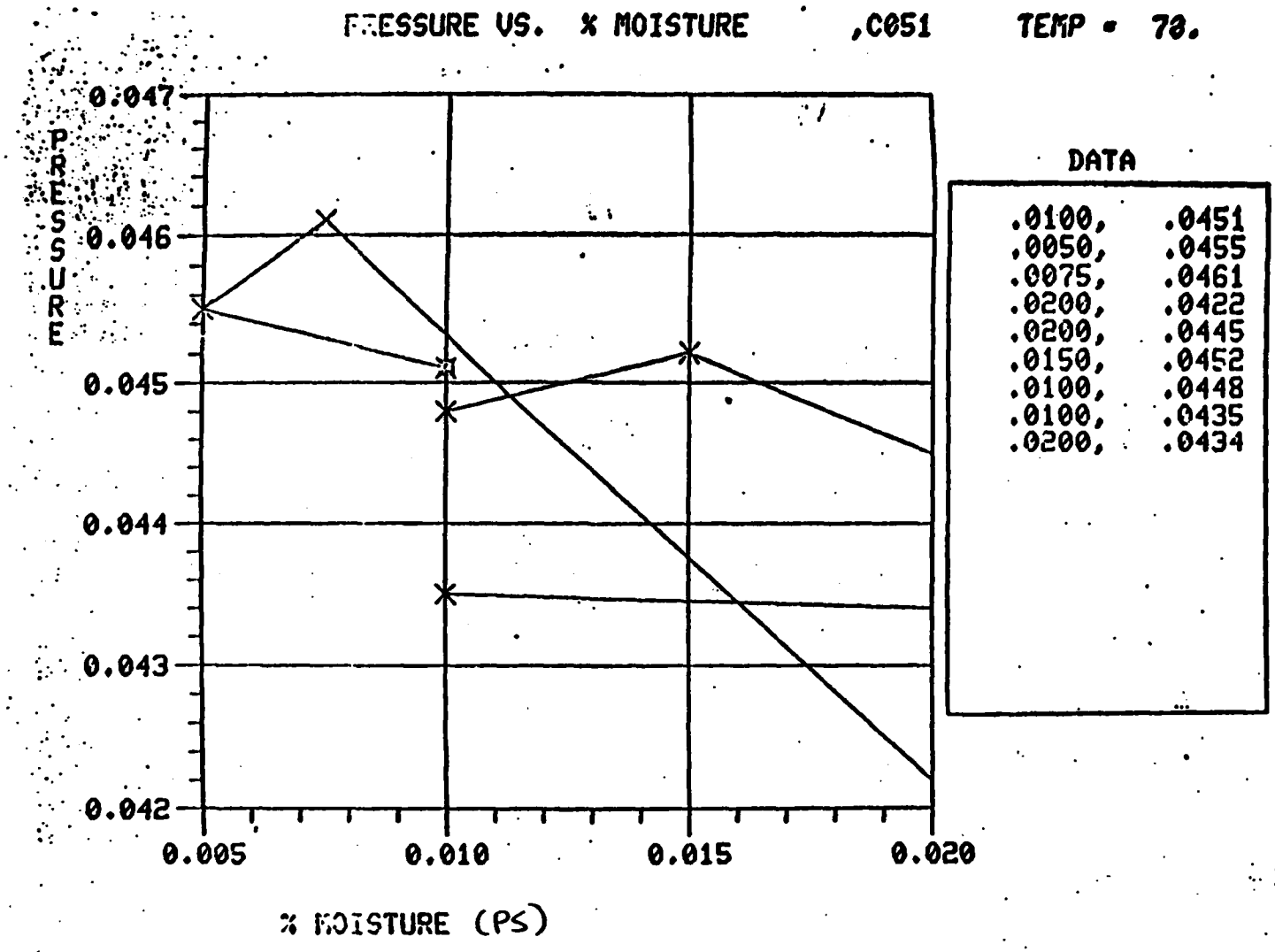

PRESSURE VS. % MOISTURE ,C051 TEMP = 70.
PRESSURE
0.047
0.046
0.045
0.044
0.043
0.042
0.005
0.010
0.015
0.020
% MOISTURE (PS)
DATA
.0100, .0451
.0050, .0455
.0075, .0461
.0200, .0422
.0200, .0445
.0150, .0452
.0100, .0448
.0100, .0435
.0200, .0434

Fig 46

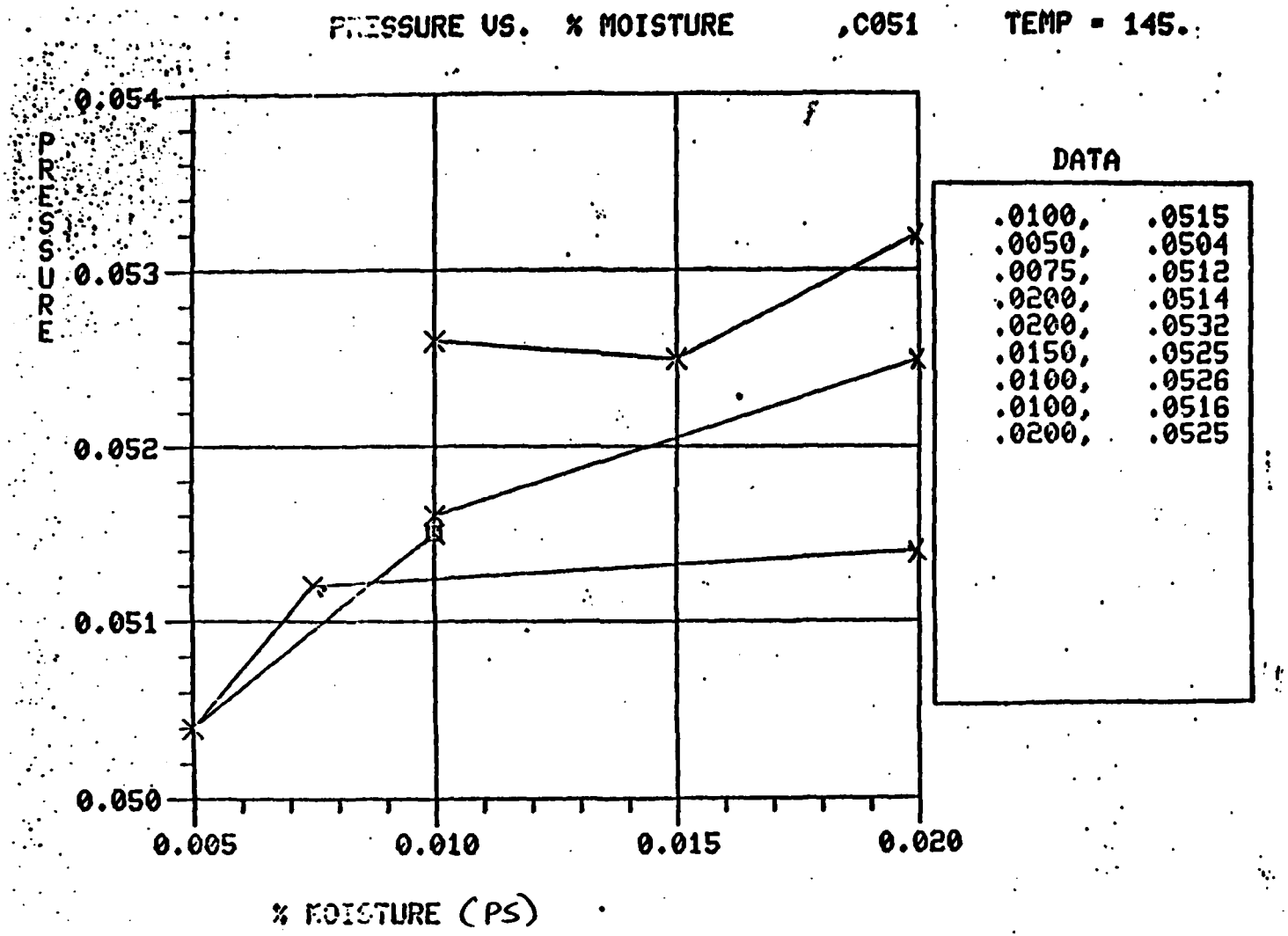

PRESSURE VS. % MOISTURE ,C051 TEMP = 145.
PRESSURE
0.054
0.053
0.052
0.051
0.050
0.005
0.010
0.015
0.020
% MOISTURE (PS)
DATA
.0100, .0515
.0050, .0504
.0075, .0512
.0200, .0514
.0200, .0532
.0150, .0525
.0100, .0526
.0100, .0516
.0200, .0525

Fig. 47

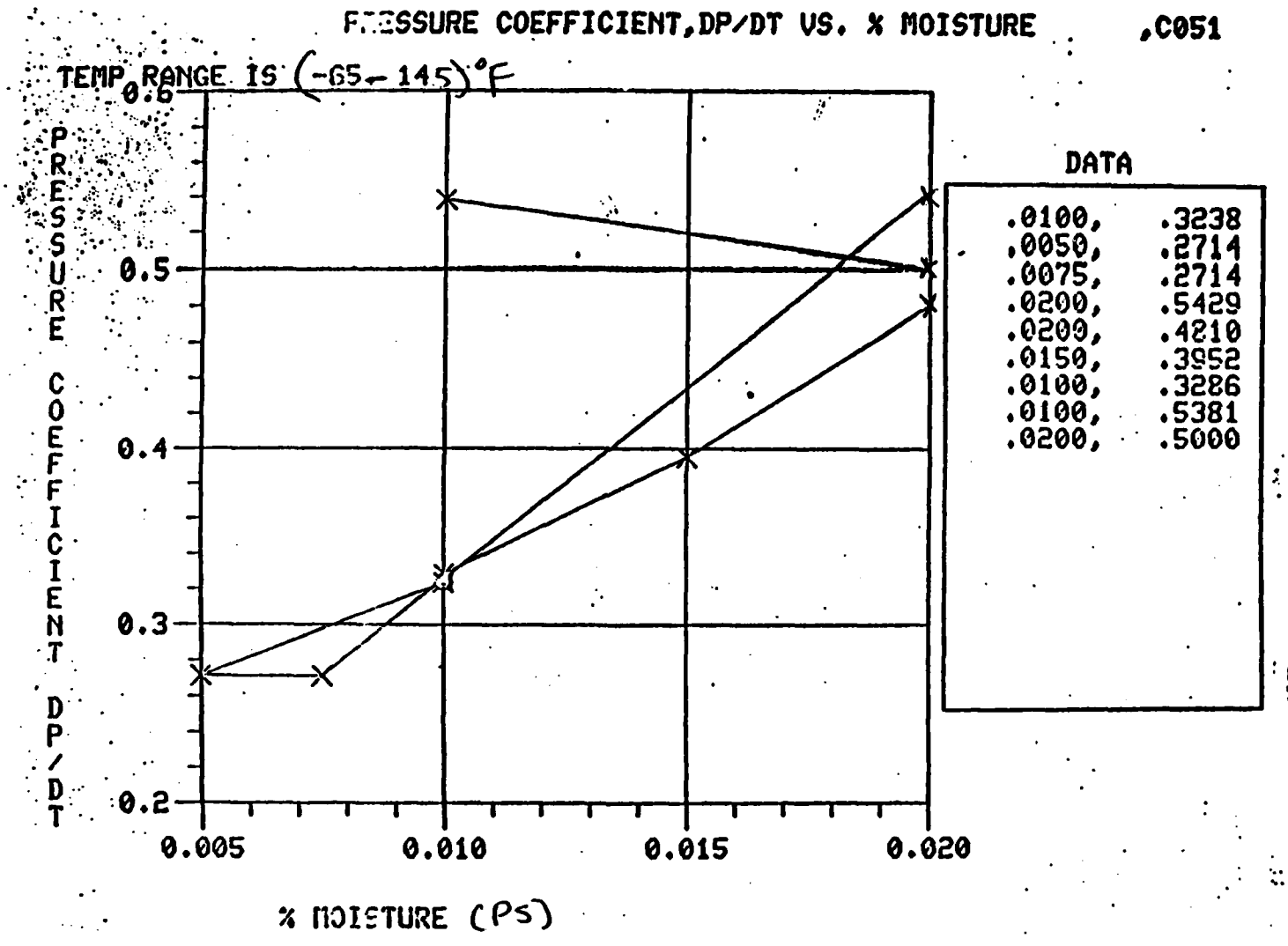

PRESSURE COEFFICIENT,DP/DT VS. % MOISTURE ,C051
TEMP RANGE IS (-65-145)°F
PRESSURE COEFFICIENT DP/DT
0.6
0.5
0.4
0.3
0.2
0.005
0.010
0.015
0.020
% MOISTURE (Ps)
DATA
.0100, .3238
.0050, .2714
.0075, .2714
.0200, .5429
.0200, .4210
.0150, .3952
.0100, .3286
.0100, .5381
.0200, .5000

Fig. 48

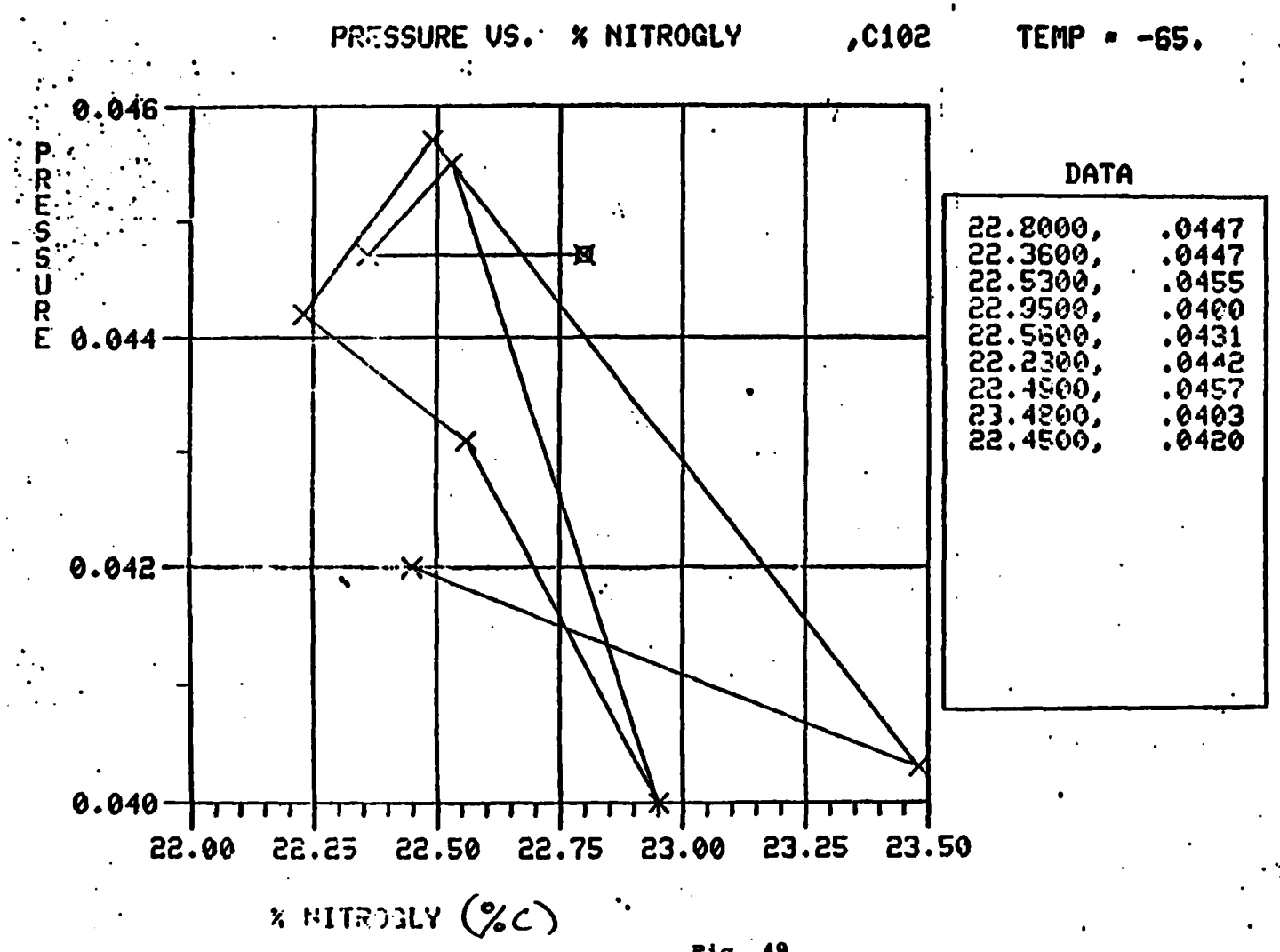

PRESSURE VS. % NITROGLY ,C102 TEMP = -65.
PRESSURE
0.046
0.044
0.042
0.040
22.00
22.25
22.50
22.75
23.00
23.25
23.50
% NITROGLY (%C)
DATA
22.8000, .0447
22.3600, .0447
22.5300, .0455
22.9500, .0400
22.5600, .0431
22.2300, .0442
22.4900, .0457
23.4200, .0403
22.4500, .0420

Fig. 49

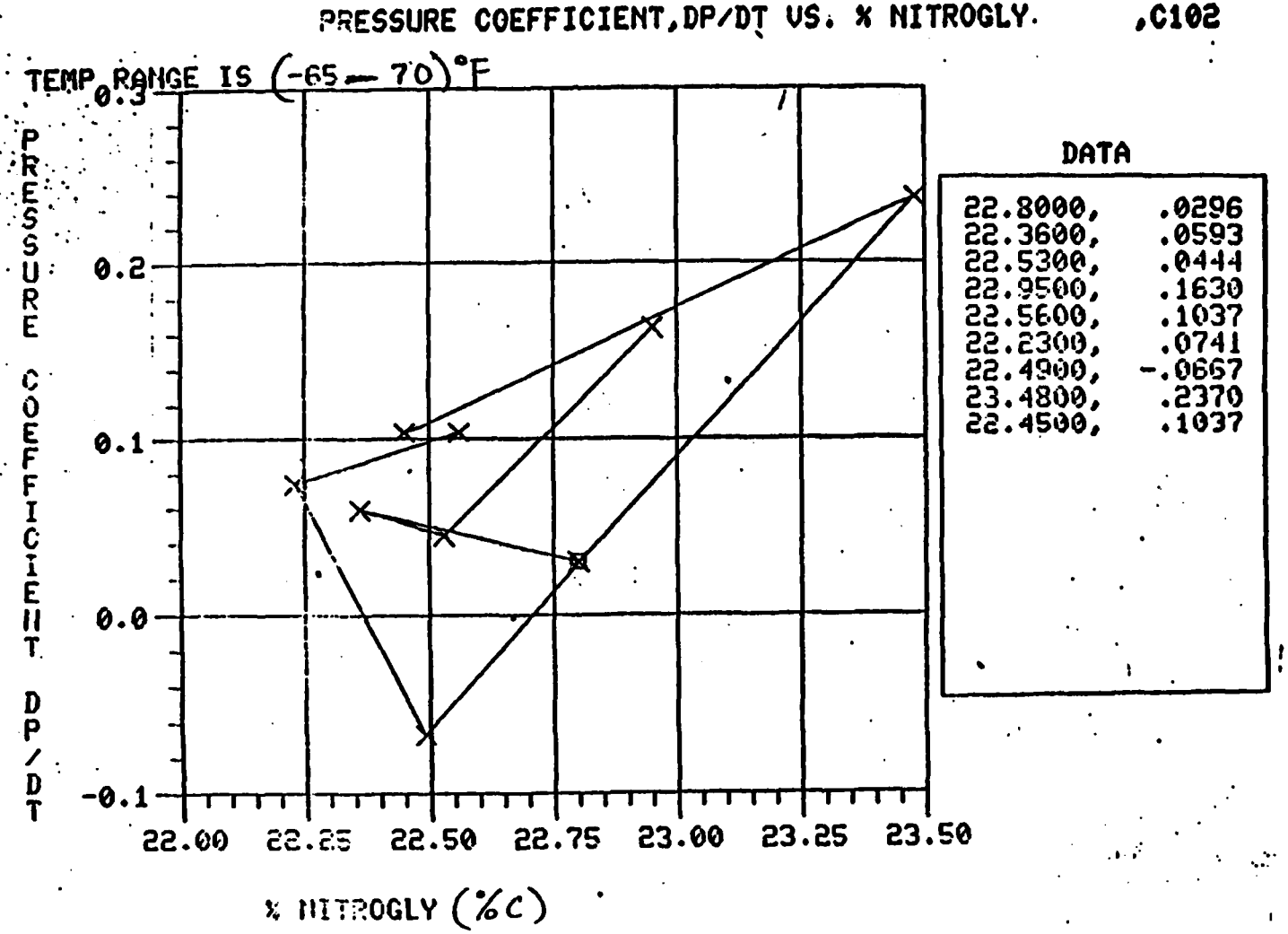

PRESSURE COEFFICIENT, DP/DT VS. % NITROGLY. ,C102
TEMP RANGE IS (-65 — 70)°F
PRESSURE COEFFICIENT DP/DT
0.3
0.2
0.1
0.0
-0.1
22.00
22.25
22.50
22.75
23.00
23.25
23.50
% NITROGLY (%C)
DATA
22.8000, .0296
22.3600, .0593
22.5300, .0444
22.9500, .1630
22.5600, .1037
22.2300, .0741
22.4900, -.0667
23.4800, .2370
22.4500, .1037

Fig. 59

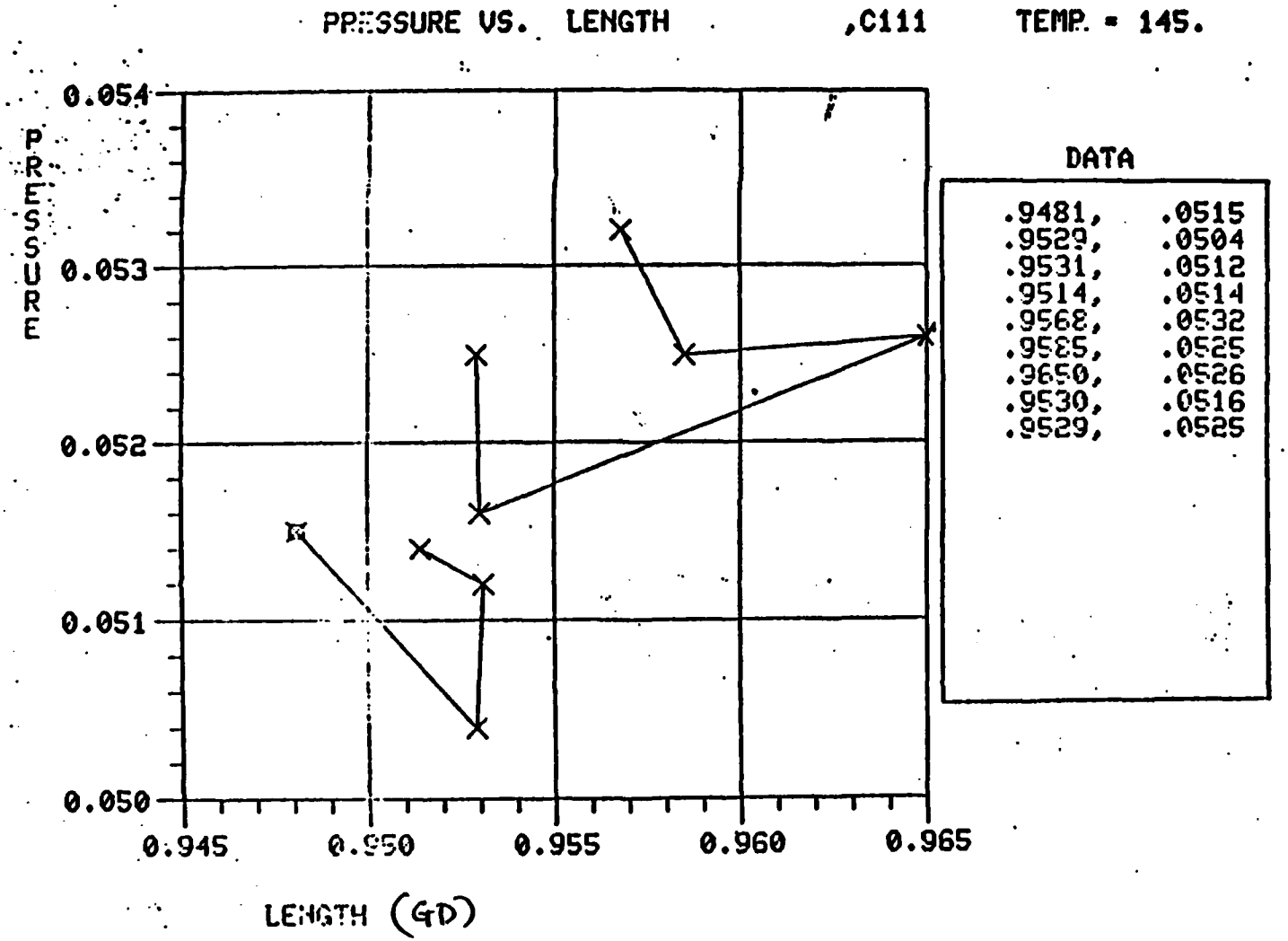

PRESSURE VS. LENGTH ,C111 TEMP. = 145.
PRESSURE
0.054
0.053
0.052
0.051
0.050
0.945
0.950
0.955
0.960
0.965
LENGTH (GD)
DATA
.9481, .0515
.9529, .0504
.9531, .0512
.9514, .0514
.9568, .0532
.9585, .0525
.9650, .0526
.9530, .0516
.9529, .0525

Fig. 51

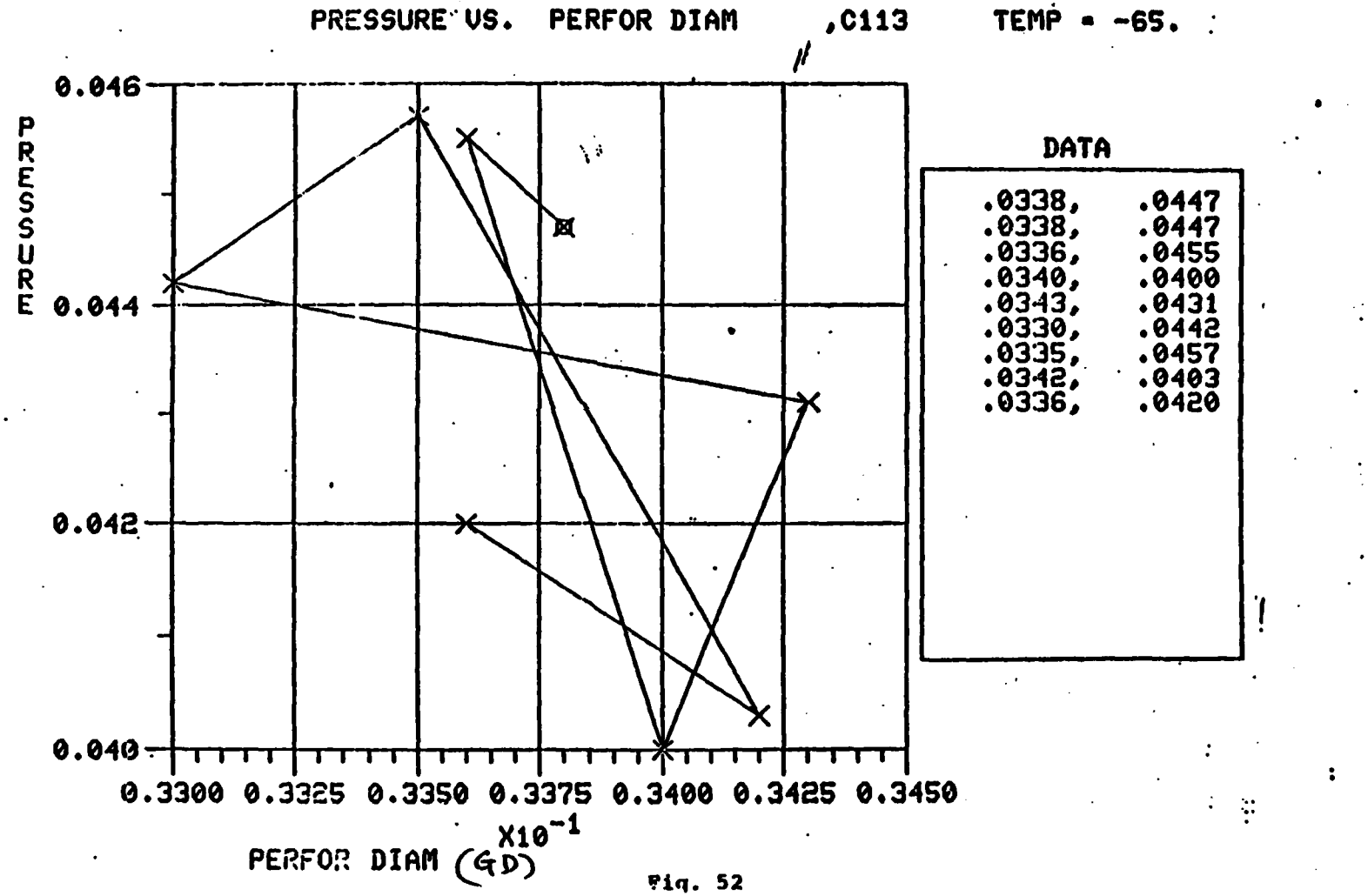

PRESSURE VS. PERFOR DIAM ,C113 TEMP = -65.
PRESSURE
0.046
0.044
0.042
0.040
0.3300 0.3325 0.3350 0.3375 0.3400 0.3425 0.3450
X10^-1
PERFOR DIAM (GD)
DATA
.0338, .0447
.0338, .0447
.0336, .0455
.0340, .0400
.0343, .0431
.0330, .0442
.0335, .0457
.0342, .0403
.0336, .0420

Fig. 52

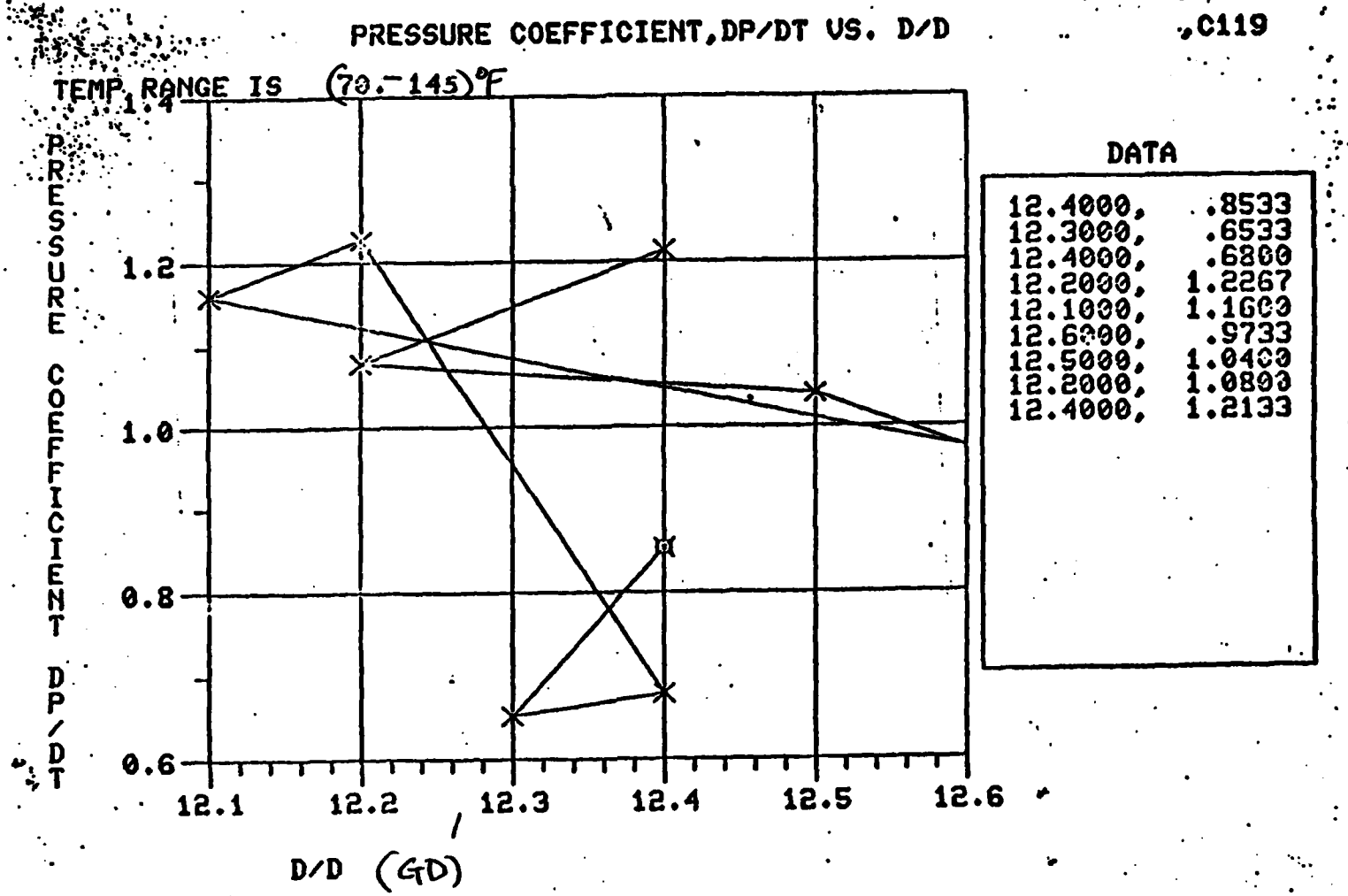

PRESSURE COEFFICIENT, DP/DT VS. D/D
C119
TEMP RANGE IS (70.-145)°F
PRESSURE COEFFICIENT DP/DT
1.4
1.2
1.0
0.8
0.6
12.1
12.2
12.3
12.4
12.5
12.6
D/D (GD)
DATA
12.4000, .8533
12.3000, .6533
12.4000, .6800
12.2000, 1.2267
12.1000, 1.1600
12.6000, .9733
12.5000, 1.0400
12.2000, 1.0800
12.4000, 1.2133

Fig. 53

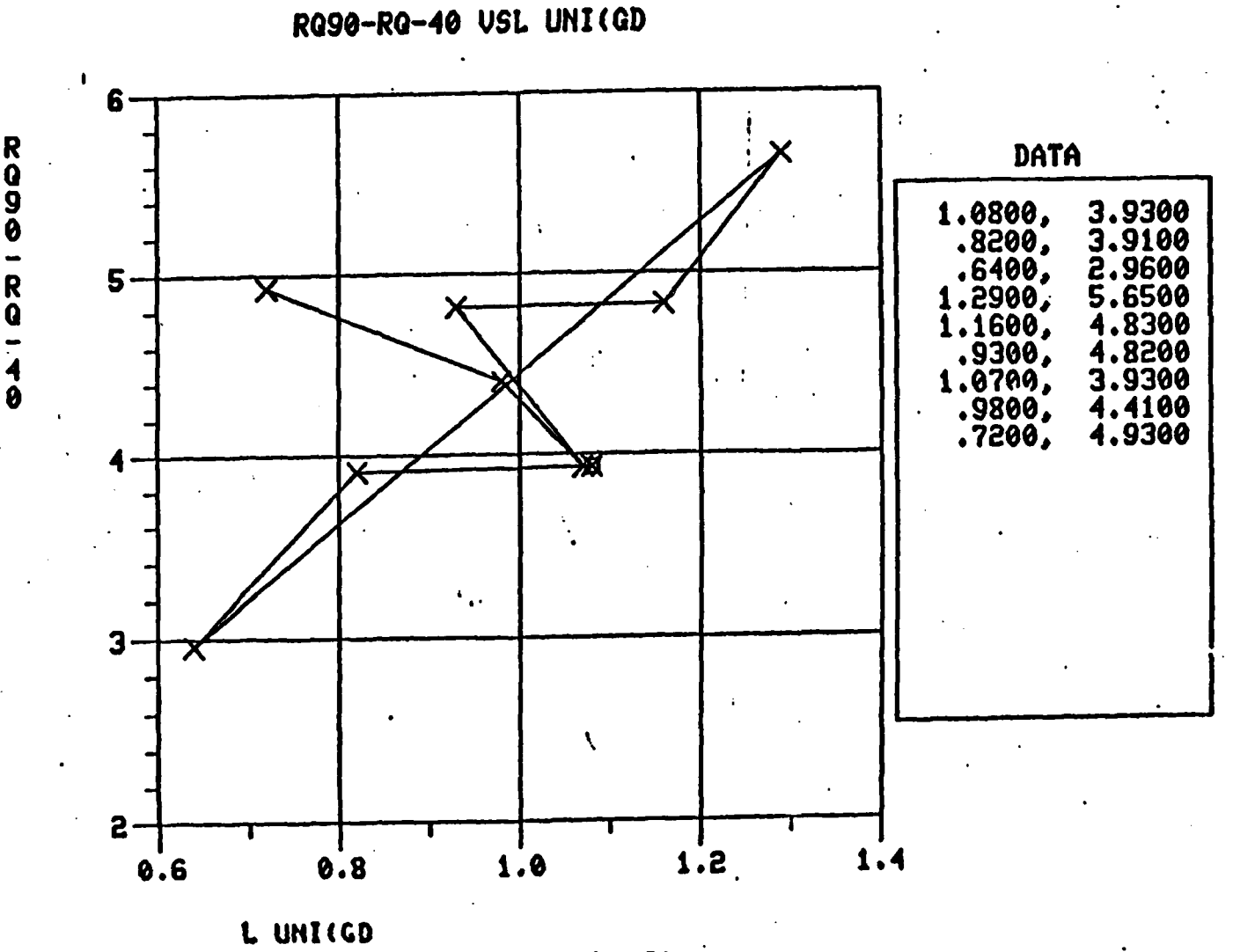

RQ90-RQ-40 VSL UNI(GD
RQ90-RQ-40
6
5
4
3
2
0.6
0.8
1.0
1.2
1.4
L UNI(GD
DATA
1.0800, 3.9300
.8200, 3.9100
.6400, 2.9600
1.2900, 5.6500
1.1600, 4.8300
.9300, 4.8200
1.0700, 3.9300
.9800, 4.4100
.7200, 4.9300

Fig. 54

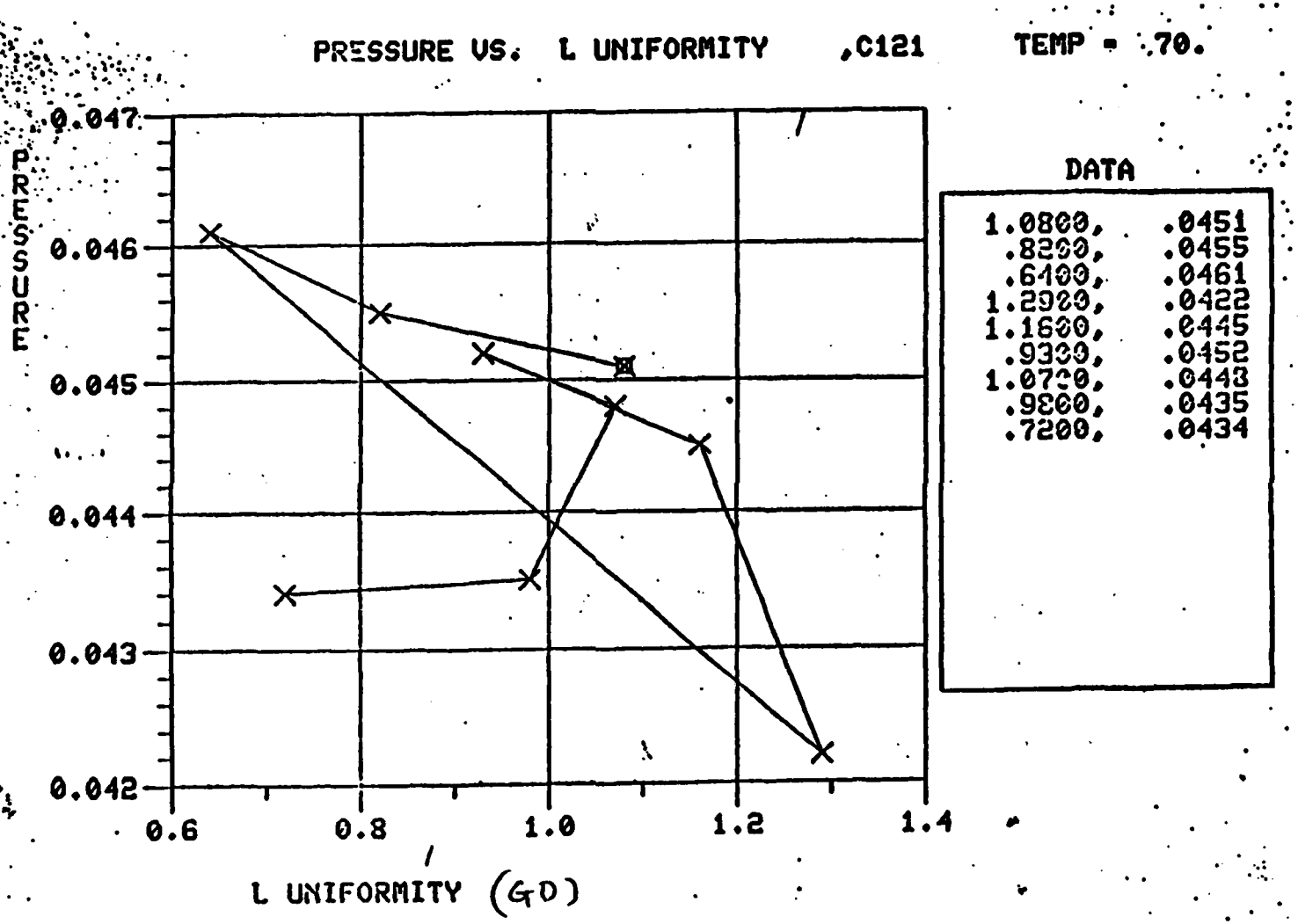

PRESSURE VS. L UNIFORMITY ,C121 TEMP = .70.
PRESSURE
0.047
0.046
0.045
0.044
0.043
0.042
0.6
0.8
1.0
1.2
1.4
L UNIFORMITY (GD)
DATA
1.0800, .0451
.8200, .0455
.6400, .0461
1.2900, .0422
1.1600, .0445
.9300, .0452
1.0700, .0443
.9800, .0435
.7200, .0434

Fig. 55

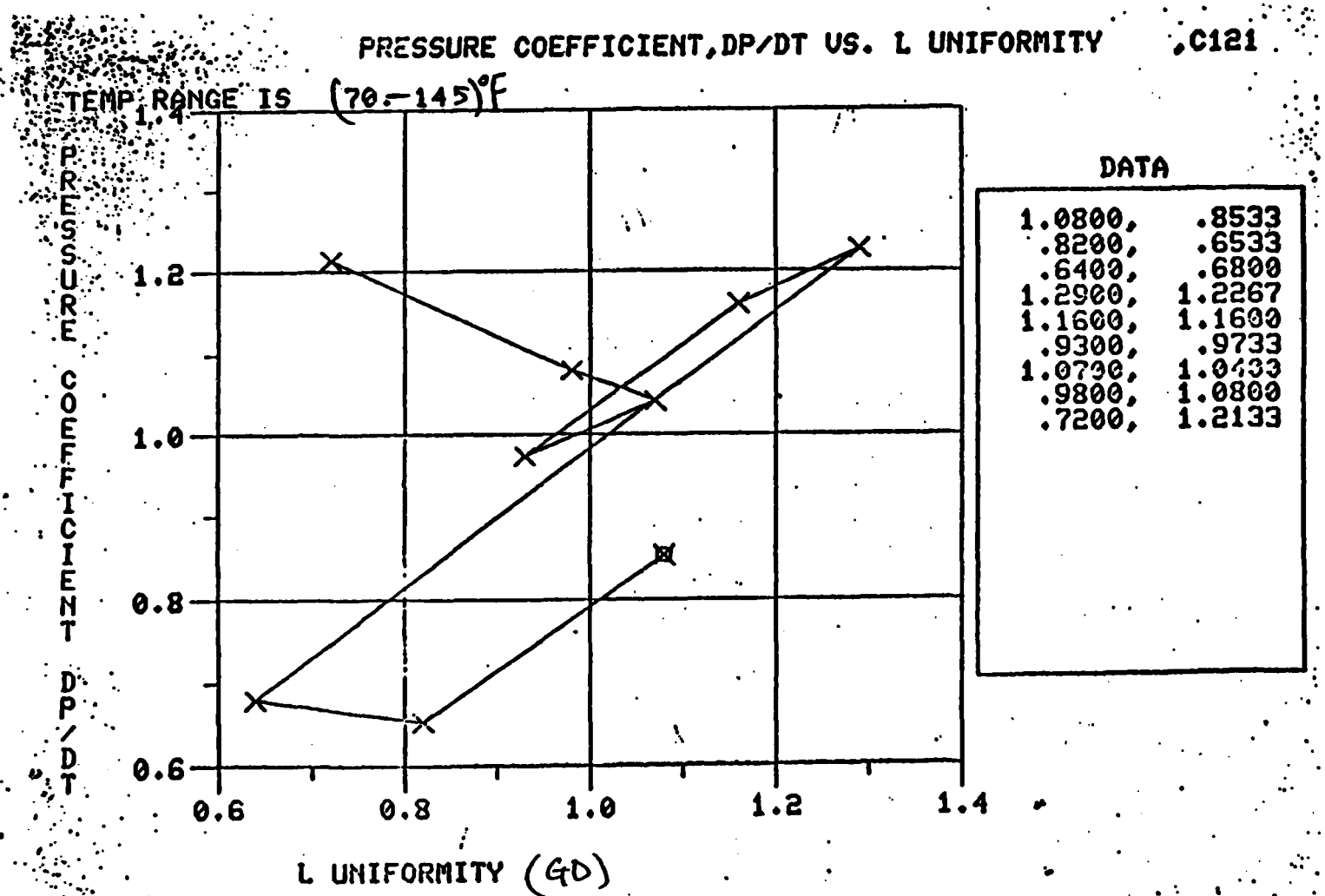

PRESSURE COEFFICIENT, DP/DT VS. L UNIFORMITY C121
TEMP RANGE IS (70.-145)°F
PRESSURE COEFFICIENT DP/DT
1.4
1.2
1.0
0.8
0.6
0.6
0.8
1.0
1.2
1.4
L UNIFORMITY (GD)
DATA
1.0800, .8533
.8200, .6533
.6400, .6800
1.2900, 1.2267
1.1600, 1.1600
.9300, .9733
1.0700, 1.0433
.9800, 1.0800
.7200, 1.2133

Fig. 56

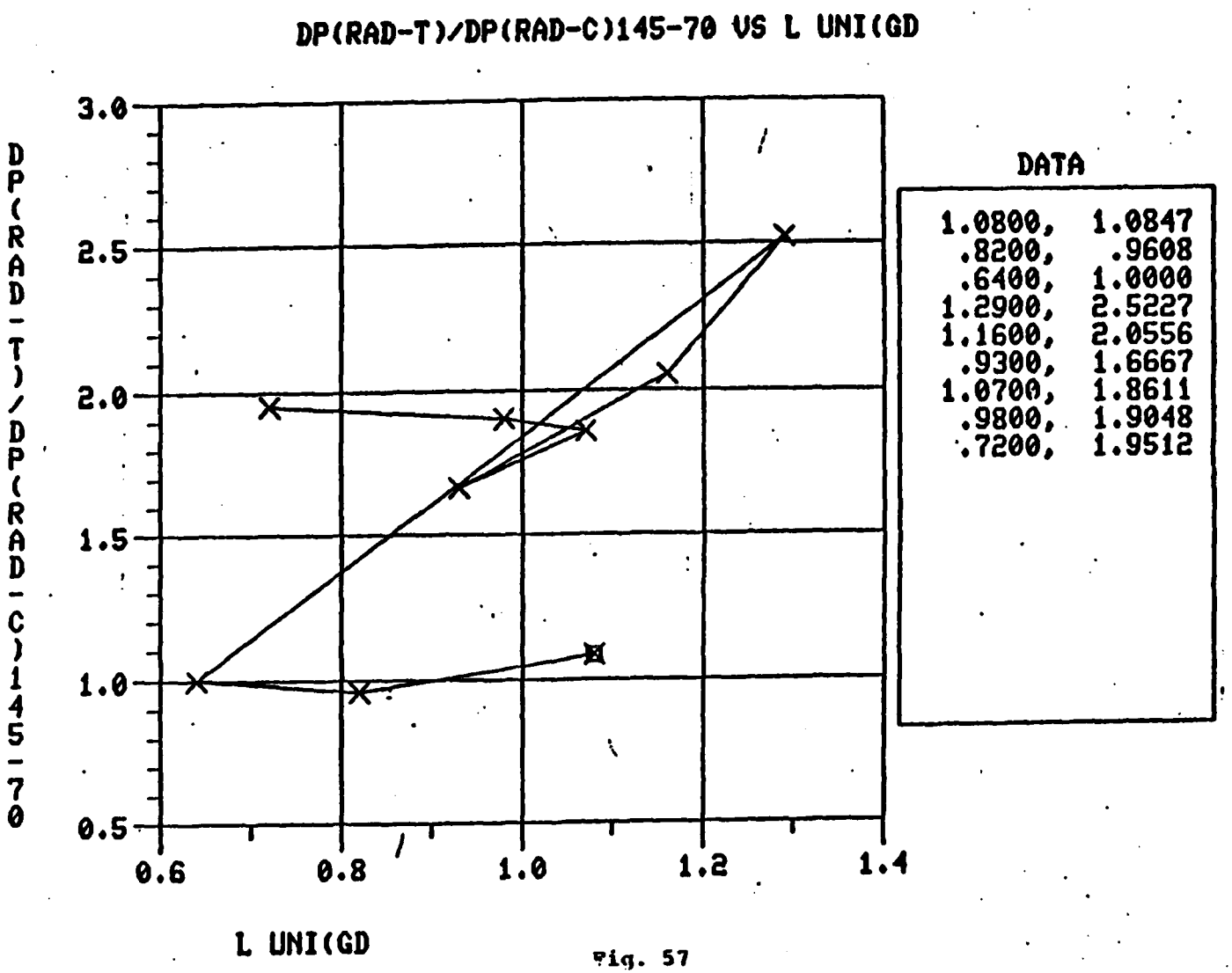

DP(RAD-T)/DP(RAD-C)145-70 VS L UNI(GD
DP(RAD-T)/DP(RAD-C)145-70
3.0
2.5
2.0
1.5
1.0
0.5
0.6
0.8
1.0
1.2
1.4
L UNI(GD
DATA
1.0800, 1.0847
.8200, .9608
.6400, 1.0000
1.2900, 2.5227
1.1600, 2.0556
.9300, 1.6667
1.0700, 1.8611
.9800, 1.9048
.7200, 1.9512

Fig. 57

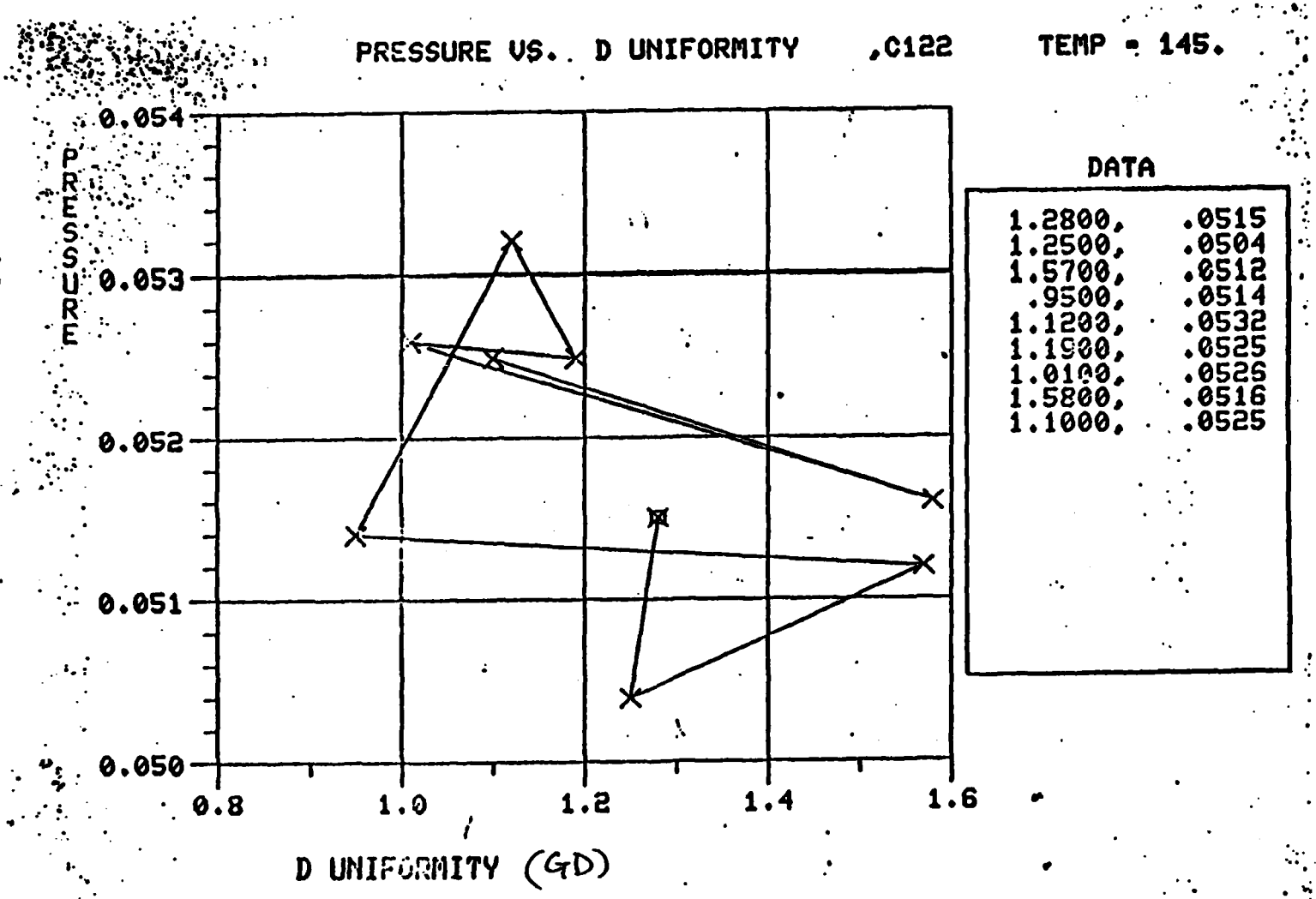

PRESSURE VS.. D UNIFORMITY ,C122 TEMP = 145.
PRESSURE
0.054
0.053
0.052
0.051
0.050
0.8
1.0
1.2
1.4
1.6
D UNIFORMITY (GD)
DATA
1.2800, .0515
1.2500, .0504
1.5700, .0512
.9500, .0514
1.1200, .0532
1.1900, .0525
1.0100, .0526
1.5800, .0516
1.1000, .0525

Fig. 58

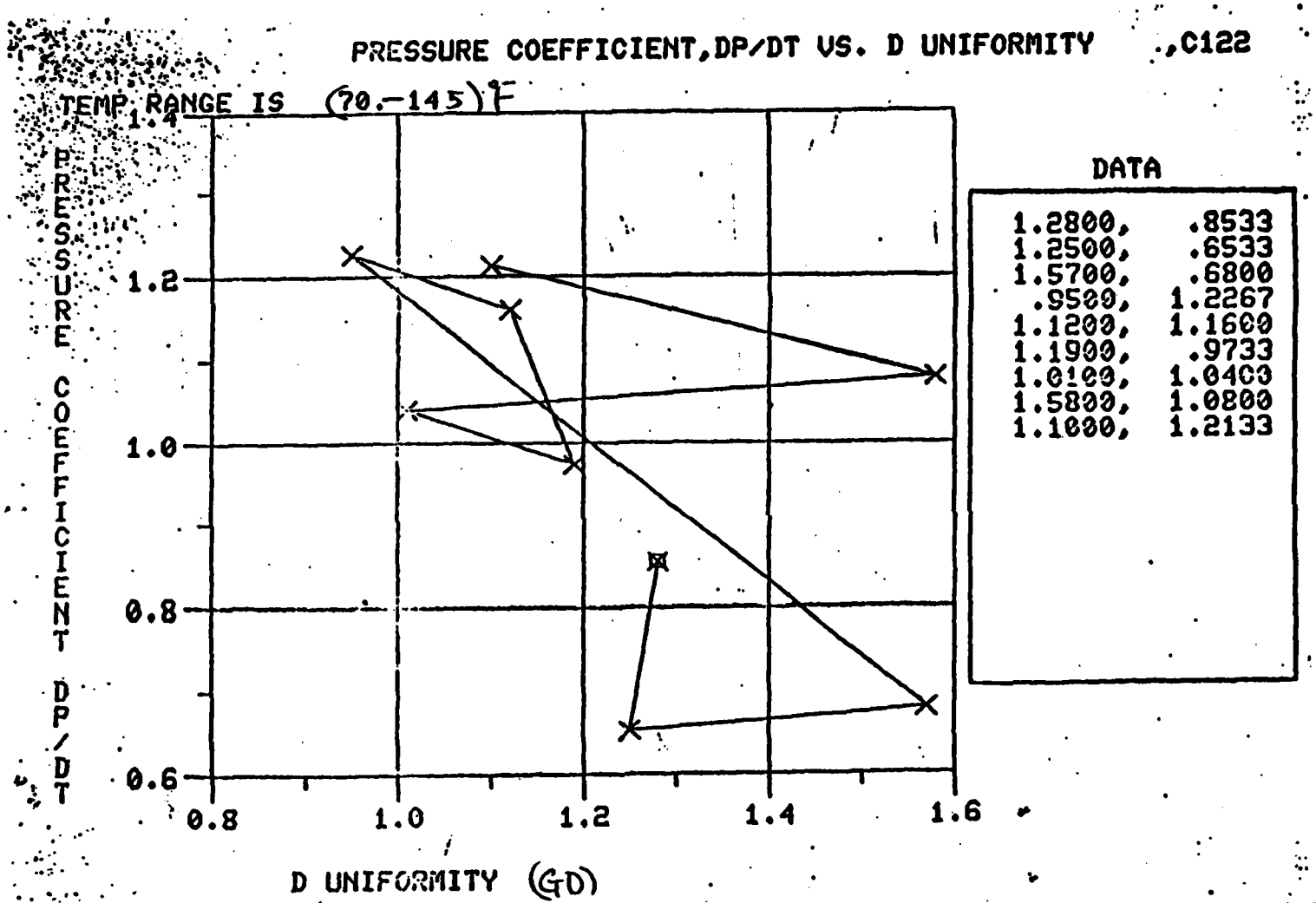

PRESSURE COEFFICIENT,DP/DT VS. D UNIFORMITY .,C122
TEMP RANGE IS (70.-145)F
PRESSURE COEFFICIENT DP/DT
1.4
1.2
1.0
0.8
0.6
0.8
1.0
1.2
1.4
1.6
D UNIFORMITY (GD)
DATA
1.2800, .8533
1.2500, .6533
1.5700, .6800
.9500, 1.2267
1.1200, 1.1600
1.1900, .9733
1.0100, 1.0400
1.5800, 1.0800
1.1000, 1.2133

Fig. 59

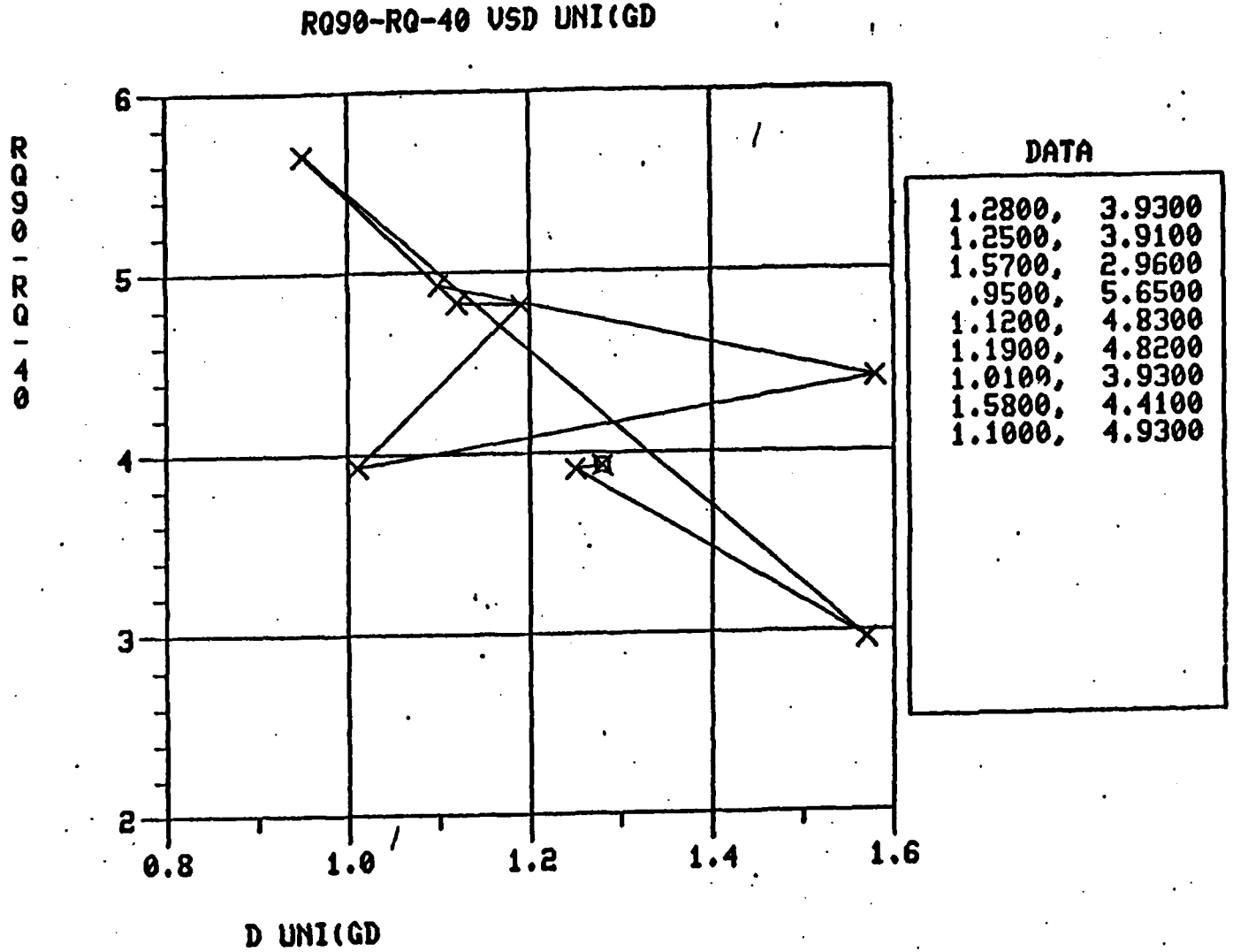

RQ90-RQ-40 VSD UNI(GD
RQ90-RQ-40
6
5
4
3
2
0.8
1.0
1.2
1.4
1.6
D UNI(GD
DATA
1.2800, 3.9300
1.2500, 3.9100
1.5700, 2.9600
.9500, 5.6500
1.1200, 4.8300
1.1900, 4.8200
1.0100, 3.9300
1.5800, 4.4100
1.1000, 4.9300

Fig. 60

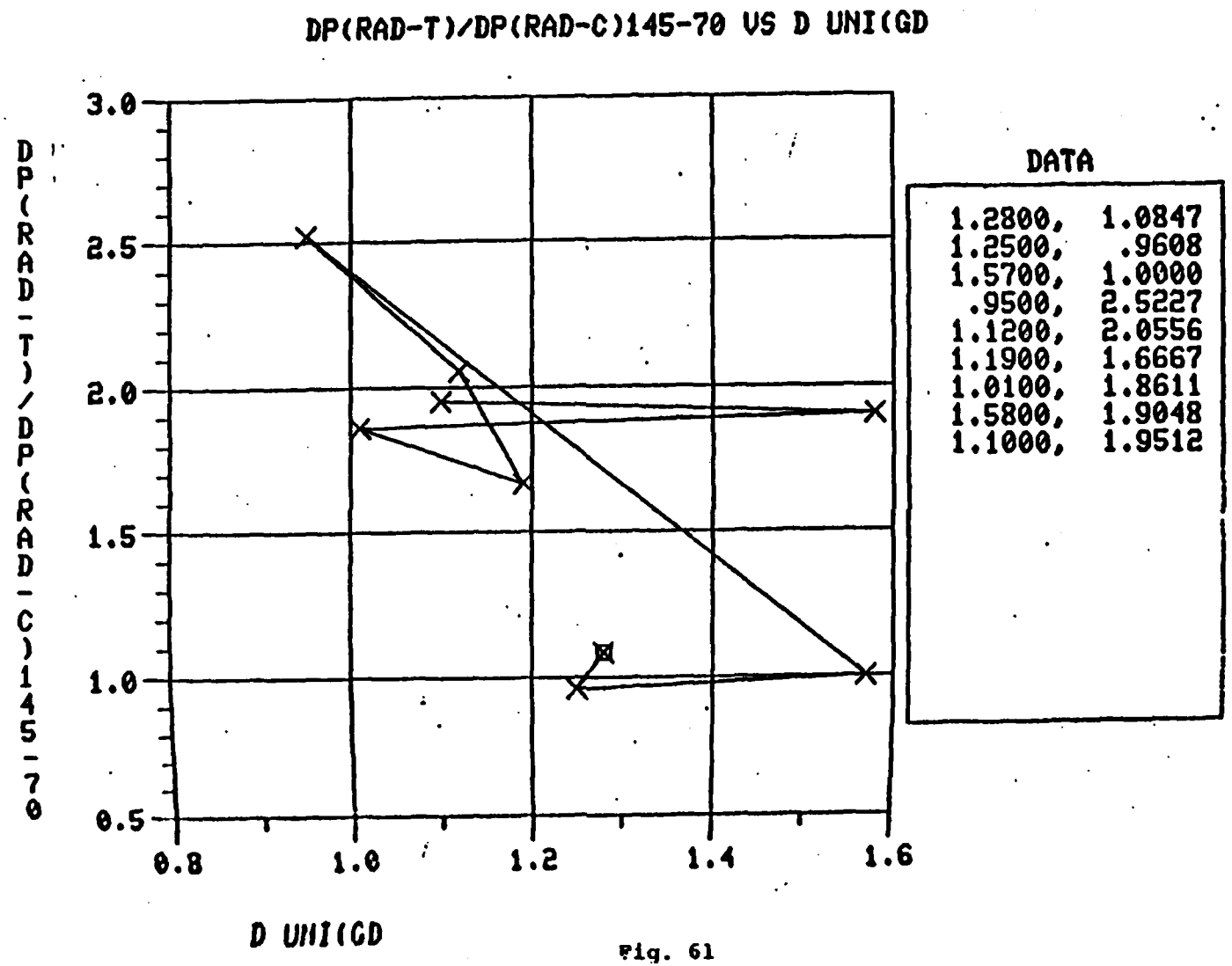

DP(RAD-T)/DP(RAD-C)145-70 VS D UNI(GD
DP(RAD-T)/DP(RAD-C)145-70
3.0
2.5
2.0
1.5
1.0
0.5
0.8
1.0
1.2
1.4
1.6
D UNI(GD
DATA
1.2800, 1.0847
1.2500, .9608
1.5700, 1.0000
.9500, 2.5227
1.1200, 2.0556
1.1900, 1.6667
1.0100, 1.8611
1.5800, 1.9048
1.1000, 1.9512

Fig. 61

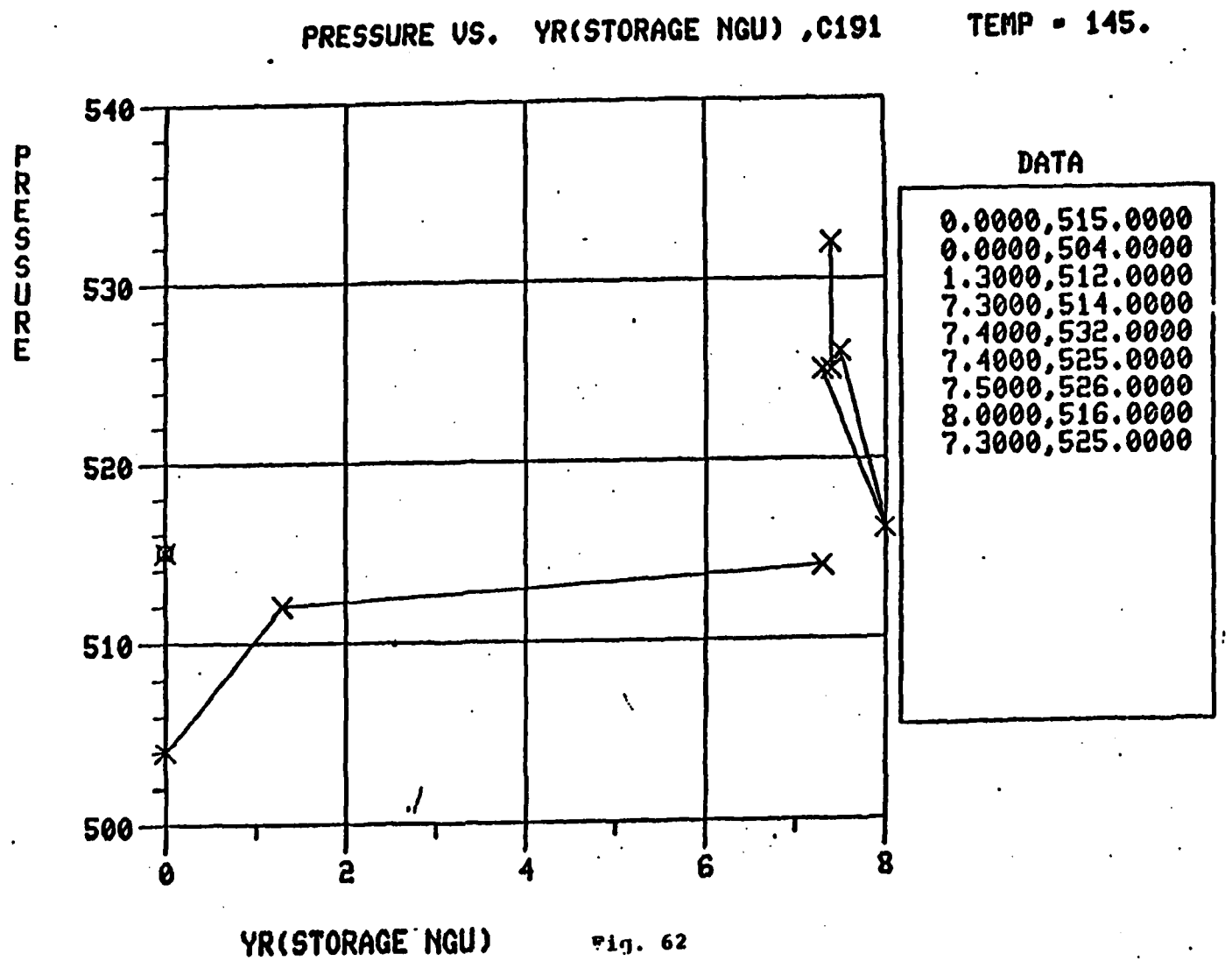

PRESSURE VS. YR(STORAGE NGU) ,C191 TEMP = 145.
PRESSURE
540
530
520
510
500
0
2
4
6
8
YR(STORAGE NGU)
DATA
0.0000,515.0000
0.0000,504.0000
1.3000,512.0000
7.3000,514.0000
7.4000,532.0000
7.4000,525.0000
7.5000,526.0000
8.0000,516.0000
7.3000,525.0000

Fig. 62

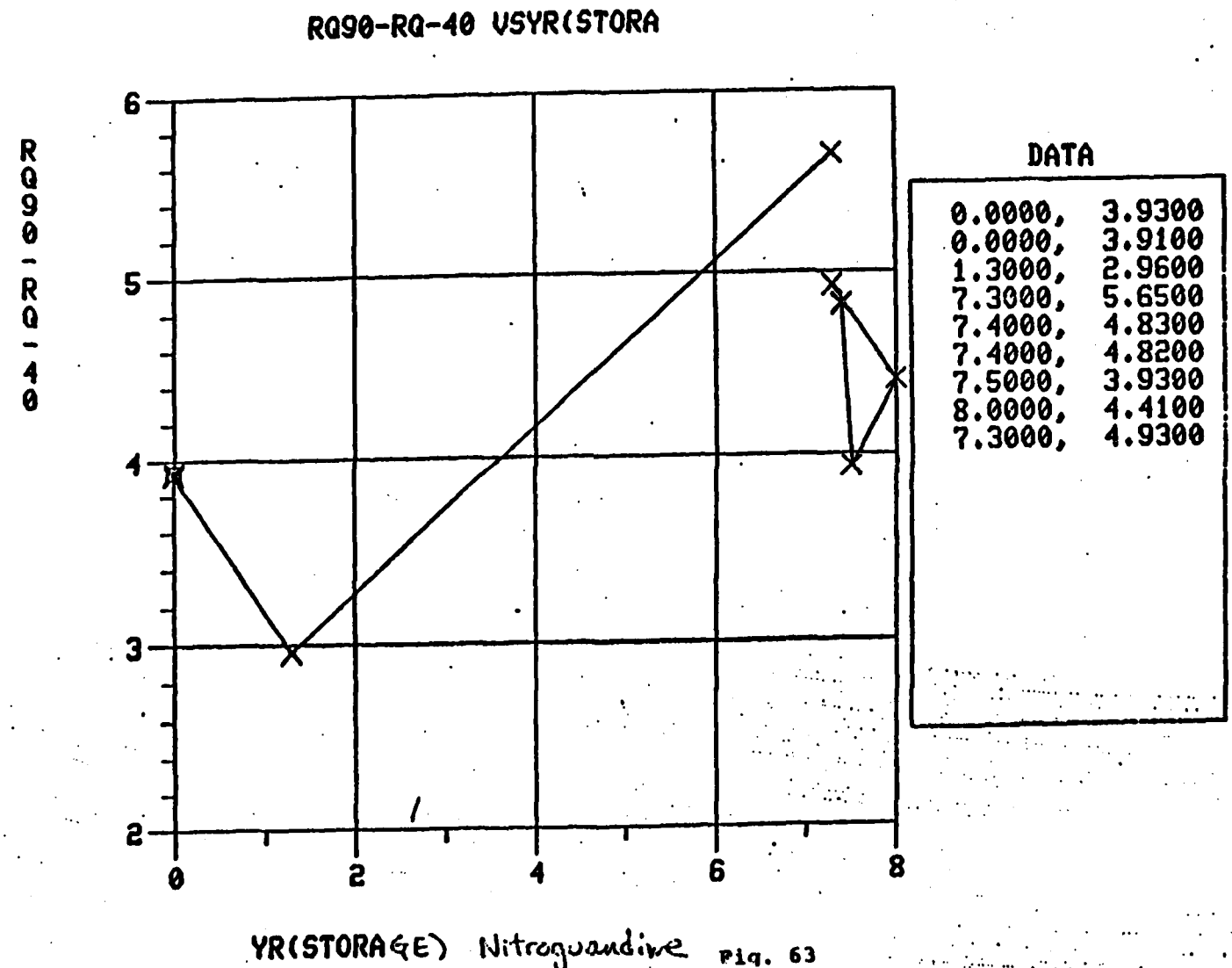

RQ90-RQ-40 VSYR(STORA
RQ90-RQ-40
6
5
4
3
2
0
2
4
6
8
DATA
0.0000, 3.9300
0.0000, 3.9100
1.3000, 2.9600
7.3000, 5.6500
7.4000, 4.8300
7.4000, 4.8200
7.5000, 3.9300
8.0000, 4.4100
7.3000, 4.9300
YR(STORAGE) Nitroguandine

Fig. 63

Appendix 2 = Stepwise Regression Analysis

The regression equation used in this analysis is described as follows:

$$Y = B_o + B_1X_1 + Bx_2 + \ldots\ldots + Bi\ Xi + \in$$

where

Y represents the dependent variable
X_1, X_2..... X_i are the independent variables
B_1, B_2....B_i are the coefficient constants of the independent variables
$\in$ is the random error in each production lots
B_o is the constant of the equation

The entering independent variables are:

1. % Total volatile (composition)
2. % Graphite (")
3. % Moisture (")
4. pH Value (Nitroguandine)

The entering dependent variables are:

1. Pressure fired at 145°F
2. DP/DT (70 - 145)°F

Table 4

Defination of the regression result:

Parameter	Explanation
R^2	Correlation coefficient; as the R^2 approaching 1.0, the equation obtained will explain 100% of the variation about the mean Y
Std Error Est.	Standard error of estimate; STD error approaching to 0.0, the calculated values from the regression equation will be approaching to the actual observed values
F Value	F distribution value is calculated for each entering independent variable. If the calculated F value is equal or greater than the predicted of F value (5.12), the independent variable will be retained in the regression equation; otherwise, the variable will be rejected.

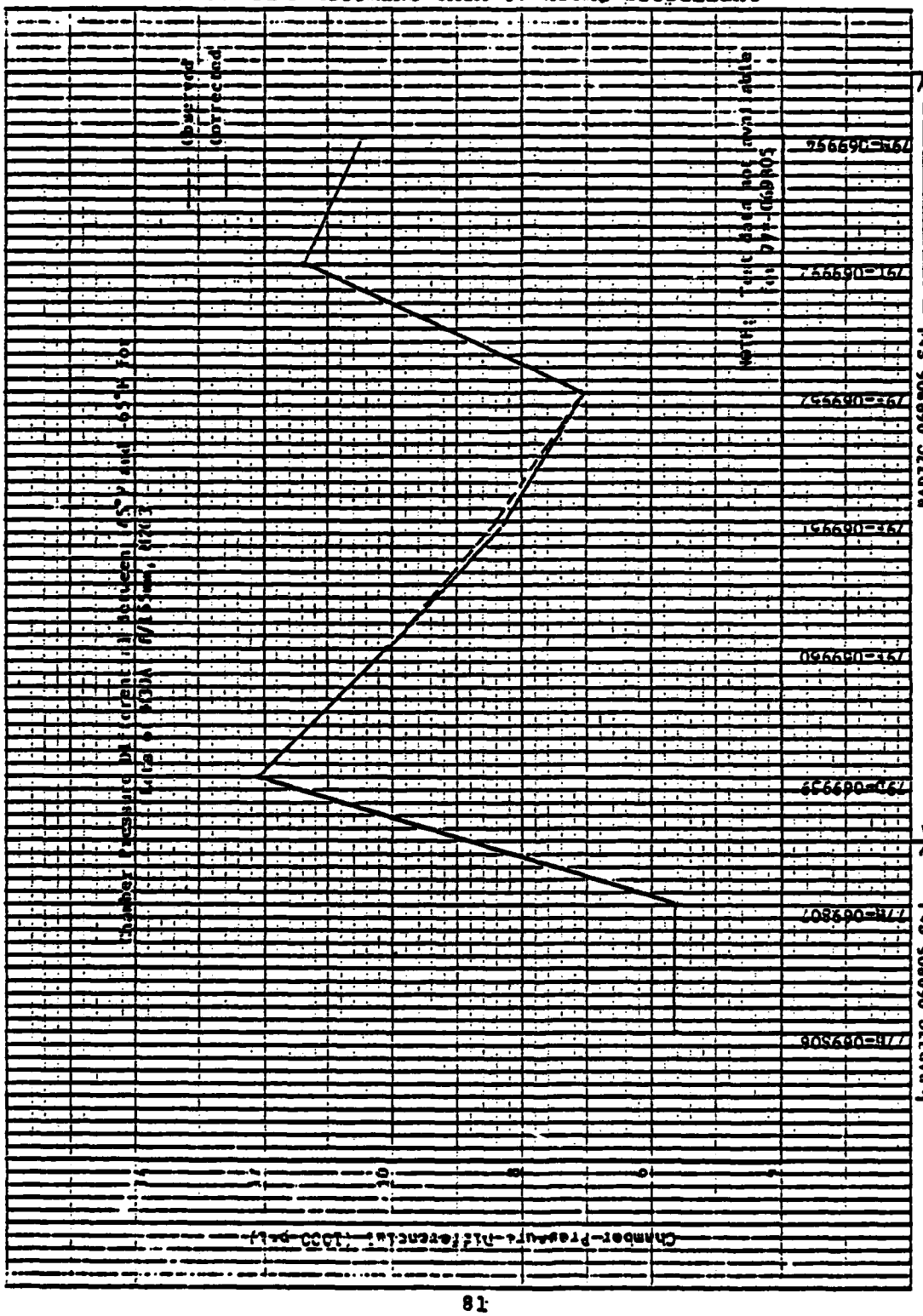
Table 5: Final Result of Stepwise Regression Analysis

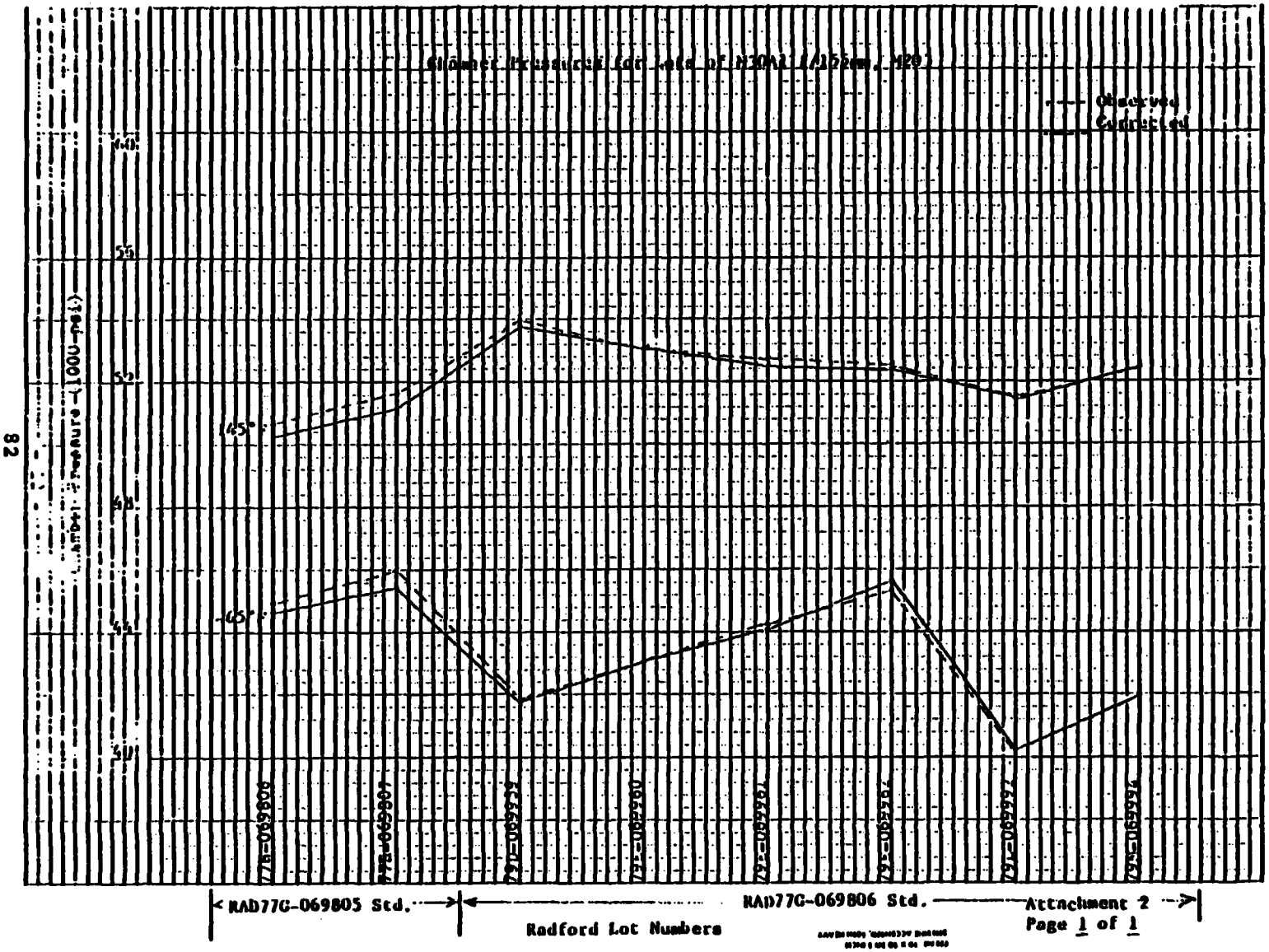
Depend Var (Y)	Indep Vars Entering	Variables Reject	Variables Retain
Pressure (145)°F	X_1 = % Total Volatiles X_2 = % Graphite X_3 = % Moist X_4 = pH	X_1 = % Total Volatiles X_2 = % Graphite X_3 = % Moist	X_4 = pH
Pressure (145)°F	X_1 = % Total Volatile X_2 = % Graphite X_3 = % Moist	X_2 = % Graphiute X_3 = % Moist	X_1 = % Total Volatile
DP/DT_2 (70-145)°F	X_1 = % Total Volatile X_2 = % Graphite X_3 = % Moist X_4 = pH	X_1 = % Total Volatile X_3 = % Moist X_4 = pH	X_2 = % Graphite
DP/DT_2 (70 -145)°F	X_1 = % Total Volatile X_3 = % Moist X_4 = pH	X_4 = pH	X_1 = % Total Volatile X_3 = % Moist

Table 5 Continue

Y	Variables retain	R^2 for Retain Var(s)	STD Error Est of Retain Var	F Value	Final Regression Equation
				less than 5.12	
				less than 5.12	
				less than 5.12	
Pressure (145°F)	X_4= pH	0.6935	5.183	15.837	Y= 806.96-55.03X_4
Pressure (145°F)	X_1=% Total Volatile	0.6346	5.659	12.56	Y= 530.68-64.56X_1
				less than 5.12	
				less than 5.12	
				less than 5.12	
$DP/_{DT2}$ (70-145)°F	X_2=% Graphite	0.815	0.0993	30.9035	Y= 1.619-8.49X_2
				less than 5.12	
				less than 5.12	
$DP/_{DT2}$ (70-145)°F	X_1=% Total Volatile	0.8758	0.088	16.20	Y= 0.81-0.8X_1 +24.8X_3
				less than 5.12	
	X_3=%Moist				

APPENDIX 3: MANUFACTURING DATA OF M30A1 propellant




Observed
Calculated
145°
-65°
RAD77G-069805 Std.
RAD77G-069806 Std.
Radford Lot Numbers
Attachment 2
Page 1 of 1

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M30A1 Propellant for 155mm, M203 Source of Ingredients

Ingredient	Ingredient Source - By Lot								
	69805	69806	69807	69959	69960	69961	69962	69992	69994
Nitrocellulose	Hercules RAAP	Same	Same	Same	Same	Same	Same	Same	Same
Nitroglycerin	Hercules RAAP	Same	Same	Same	Same	Same	Same	Same	Same
Nitroguanidine	GFH Cyanamid of Canada Ltd. (Shipper)	Same	GFH Cyanamid of Canada Ltd. (Shipper) Ravenna AAP (Shipper)	GFH Ravenna AAP (Shipper)	Same	Same	Same	Same	Same
Ethyl Centralite	Chemische Werke Lowi West Germany	Same	Same	Van de Mark New York	Same	Same	Same	Same	Same
Potassium Sulfate	GFH Naval Ammo Dupot Crane, Ind. (Shipper)	Same	Same	Same	Same	Same	Same	Mallinckrodt, Inc.	Same
Graphite	Joseph Dixon Crucible Company	Same	Same	Same	Same	Same	Same	Same	Same

NITROCELLULOSE
M30A1 f/155MM, M203 Propellant

Lot No.	N. C. Blend	Percent N_2	Ether-Alcohol Solubility Percent	Fineness ML	KI Starch Time/Min	German Time/Min	Acetones Insol. Percent	Ash Percent	Vis Sec.	Freeness ML.
Requirements MIL-N 244A		12.6 ± 0.10	99 min.	--	35' min.	30' min	0.4 max	0.4 max	--	--
RAD77G-069805	C35,556	12.58	99+	84	N/A	30	TR	N/A	12	502
	557	12.59	"	86	45+	30+	"	.04	13	480
	558	12.60	"	86	"	30	"	.06	9	486
	565	12.53	"	90	"	30+	"	.05	14	522
	566	12.52	"	90	"	30+	"	N/A	14	512
	570	12.59	"	90	N/A	30+	"	N/A	14	512
	573	12.62	"	82	N/A	30+	"	N/A	13	453
	576	12.58	"	74	N/A	30	"	N/A	11	507
	577	12.50	"	82	N/A	30	"	N/A	11	510
	579	12.56	"	82	45+	30+	"	.02	10	467
RAD77H-069806	C35,571	12.61	"	88	45+	30+	"	.03	10	470
	572	12.59	"	88	N/A	30+	"	N/A	14	490
	573	12.60	"	82	N/A	30+	"	N/A	13	453
	579	12.56	"	82	45+	30+	"	.02	10	467
	581	12.51	"	88	N/A	30	"	N/A	11	507
	583	12.52	"	78	45+	30+	"	.15	13	501
	585	12.55	"	82	N/A	30	"	N/A	13	515
	586	12.50	"	79	45+	30+	"	.05	14	483
	591	12.60	"	94	N/A	30	"	N/A	14	451
	592	12.60	"	94	45+	30	"	.04	19	482
RAD77H-069807	C35,591	12.60	"	94	N/A	30	"	N/A	14	451
	592	12.60	"	94	45+	30	"	.04	19	482
	593	12.61	"	94	N/A	30	"	N/A	19	491
	594	12.59	"	92	45+	30	"	.04	17	487
	598	12.52	"	86	N/A	30	"	N/A	10	502
	603	12.56	"	78	45+	30	"	.04	11	485
	604	12.57	"	78	N/A	30	"	N/A	9	502
	607	12.57	"	80	N/A	30+	"	N/A	10	480
	610	12.56	"	82	N/A	30	"	N/A	11	519
	611	12.55	"	86	N/A	30+	"	N/A	11	479

NITROCELLULOSE
M30A1 f/155MM, M203 Propellant

Lot No.	N. C. Blend	Percent N_2	Ether-Alcohol Solubility Percent	Fineness ML	KI Starch Time/Min	German Time/Min	Acetones Insol. Percent	Ash Percent	Vis Sec.	Freeness ML.
Requirements MIL-N-244A		12.6 ± 0.10	99 min	--	35' min.	30' min	0.4 max	0.4 max	--	--
RAD79D-069959	C36,275	12.59	99+	94	45+	30	TR	.01	13	498
	277	12.55	"	94	45+	30+	"	.02	13	556
	281	12.62	"	96	45+	30	"	.03	13	480
	284	12.66	"	92	45+	30+	"	.01	14	534
	286	12.62	"	92	45+	30	"	.03	13	523
RAD79E-069960	C36,275	12.59	"	94	45+	30	"	.01	13	498
	277	12.55	"	94	45+	30+	"	.02	13	556
	281	12.62	"	96	45+	30	"	.03	13	480
	286	12.62	"	92	45+	30	"	.03	13	523
	290	12.62	"	90	45+	30	"	.02	15	547
	291	12.63	"	98	45+	30+	"	.03	17	503
	294	12.64	"	92	45+	30+	"	.02	19	510
	300	12.59	"	88	45+	30	"	.04	16	515
	302	12.62	"	92	45+	30+	"	.04	15	527
	303	12.63	"	94	45+	30+	"	.03	15	500
RAD79E-069961	C36,302	12.62	"	92	45+	30+	"	.04	15	527
	303	12.63	"	94	45+	30+	"	.03	15	500
	305	12.70	"	90	45+	30+	"	.05	15	455
	306	12.62	"	94	45+	30+	"	.04	13	487
	307	12.60	"	94	45+	30+	"	.06	15	480
	308	12.66	"	94	45+	30	"	.02	16	450
	311	12.69	"	95	45+	30	"	.04	15	496
	312	12.69	"	95	45+	30+	"	.02	13	504
	313	12.60	"	86	45+	30	"	.01	12	498
	314	12.60	"	86	45+	30+	"	.04	12	538
	315	12.67	"	92	45+	30	"	.04	13	492

NITROCELLULOSE
M30A1 f/155MM, M203 Propellant

Lot No.	N. C. Blend	Percent N_2	Ether-Alcohol Solubility Percent	Fineness ML	KI Starch Time/Min	German Time/Min	Acetones Insol. Percent	Ash Percent	Vis Sec.	Freeness ML.
Requirement MIL-N-244A		12.6 ± 0.10	99 min	--	35' min	30' min	0.4 max	0.4 max	--	--
RAD79E-069962	C36,317	12.69	99+	92	45+	30	TR	.02	11	476
	318	12.69	"	82	45+	30	"	.02	13	488
	319	12.68	"	94	45+	30	"	.01	15	505
	320	12.65	"	94	45+	30	"	.05	17	472
	321	12.65	"	90	45+	30	"	.01	15	525
	322	12.66	"	90	45+	30	"	.03	11	450
	323	12.65	"	84	45+	30	"	.05	12	467
	325	12.61	"	84	45+	30	"	.02	10	485
	327	12.60	"	86	45+	30	"	.02	10	480
	328	12.61	"	86	45+	30	"	.06	10	496
RAD79L-069992	C36,423	12.53	"	90	45+	30	"	.04	11	482
	426	12.53	"	98	45+	30	"	.04	12	470
	433	12.60	"	76	45+	30+	"	.02	14	536
	434	12.59	"	78	45+	30+	"	.03	9	529
	436	12.58	"	78	45+	30+	"	.03	11	492
	440	12.53	"	82	45+	30+	"	.03	10	490
	444	12.55	"	70	45+	30+	"	.03	8	465
RAD79M-069994	C36,436	12.58	"	78	45+	30+	"	.03	11	492
	437	12.61	"	76	45+	30+	"	.02	9	498
	438	12.58	"	76	45+	30+	"	.02	10	539
	440	12.53	"	82	45+	30+	"	.03	10	490
	442	12.62	"	78	45+	30+	"	.02	9	458
	444	12.55	"	70	45+	30+	"	.03	8	465
	445	12.52	"	78	45+	30+	"	.02	9	501
	450	12.56	"	82	45+	30+	"	.02	9	462
	452	12.58	"	72	45+	30	"	.03	9	473

NITROGLYCERIN
M30A1 f/155MM, M203 PROPELLANT

Lot No.	Charge No.	KI (Min.)	Alk.	Acidity	H_2O	N_2
Requirements MIL-N-246B		10 min	0.002% Max		0.5% Max	18.40% Min
RAD77G-69805	149, 151	15				
	154, 155	15				
	168, 171	15				
	166, 162	15				
	169, 163	15				
	164, 159, 158	15				
	170-	15	None		.38	18.45
	178, 173	15				
	172, 179	15				
	174, 175	15				
	176, 186	15				
	185, 183	15				
	182, 181	15				
	180-	15	None		.34	18.44
	2, 1, 4	15				
	13, 12, 6	15				
	5, 11, 8	15				
	7, 15	15				
	20-	15	None		.22	18.45
	19, 17	15				
	21	15			.26	
	16, 14, 10-	15				

NITROGLYCERIN
M30A1 f/155MM, M203 PROPELLANT

Lot No.	Charge No.	KI (Min.)	Alk.	Acidity	H_2O	N_2
Requirements MIL-N-246B		10 min	0.002% Max		0.5% Max	18.40% Min
RAD77G-69805 (Cont d)	9, 33, 32	15				
	28, 27, 23	15				
	18, 26, 25	15				
	24,22, 36, 21	15				
RAD77H-069806	37, 42, 46	15				
	40-	15				
	45, 44, 48	15				
	47, 51, 52	15				
	58, 56, 53	15				
	55, 39, 38	15				
	38, 41, 54	15				
	61, 62, 68	15				
	67,71	15				
	60-	15	None	None	.35	18.45
	59, 63, 64	15				
	78, 69, 70-	15				
	79, 73, 75	15				
	77, 74, 85	15				
	86, 87, 94	15				
	84, 82, 81, 80-	15				
	76, 88, 72	15				

NITROGLYCERIN
M30A1 f/155MM, M203 PROPELLANT

Lot No.	Charge No.	KI (Min.)	Alk.	Acidity	H_2O	N_2
Requirements MIL-N-246B		10 min	0.002% Max		0.5% Max	18.40% Min
RAD77H-069807	91, 92, 98	15				
	99, 93, 96	15				
	115, 114, 109	15				
	107, 108, 106	15				
	100-	15	None	None	.25	18.46
	95, 102, 103	15				
	110	15	None	None	.35	18.48
	111, 101, 113	15				
	116, 117, 118	15				
	119, 121, 127	15				
	122, 120-, 126	15				
	124, 132, 126	15				
	146, 150-, 149	15				
	144, 147, 148	15				
	143, 142, 141	15				
	136, 135, 139	15				
	140-	15	None	None	.36	18.46
	138, 134, 130	15				
	131, 129, 133	15				

NITROGLYCERIN
M30A1 f/155MM, M203 PROPELLANT

Lot No.	Charge No.	KI (Min.)	Alk.	Acidity	H_2O	N_2
Requirements MIL-N-246B		10 Min	0.002% Max		0.5 % Max	18.40% Min
RAD79D-069959	39	17				
	40	17	--		.28	18.43
	41	--				
	42	17				
	43	--				
	44	16				
	45	17				
	46	17				
	47	15				
RAD79E-069960	49	--				
	51	16				
	52	16				
	53	--				
	54	16				
	55	17				
	56	--				
	57	16				
	58	17				
	59	18				
	60	--	None		.20	18.44
	61	16				

NITROGLYCERIN
M30A1 f/155MM, M203 PROPELLANT

Lot No.	Charge No.	KI (Min.)	Alk.	Acidity	H_2O	N_2
Requirements Mil.-N-2468		10 Min	0.002% Max		0.5% Max	18.40% Min
NAD79E-069960 (cont'd)	1, 2	17				
	3	16				
	4, 5, 6	17				
	7, 8, 9, 10	17				
	11	16				
	12, 13, 14	17				
	15	16				
	16	17				
	17	--				
	18	16				
	19	15				
	20	--	None		.39	18.44
	21	18				
	23	17				
	25	16				
	26	16				
	27, 28	17				
	29	18				
	30, 31, 32	17				
	33, 34,	17				
	35, 36	16				
	37, 38, 39	17				

NITROGLYCERIN
M30A1 E/155MM, M203 PROPELLANT

Lot No.	Charge No.	KI (Min.)	Alka.	Acidity	H_2O	N_2
Requirements MIL-N-2468		10 Min	0.002% Max		0.5% Max	18.40% Min
RAD79E-069961	40	17			.28	18.42
	41	--				
	42, 43,	17				
	44	18				
	45	--				
	46, 47, 48	17				
	49,	17				
	50	17	None		.31	18.49
	51	17				
	52	16				
	53, 54	17				
	55	--				
	56	18				
	57	17				
	58	--				
	59	17				
RAD79E069962	1, 2	17				
	3	16				
	4, 5	17				
	6	16				
	7	--				
	8	17				

NITROGLYCERIN
M30A1 f/155MM, M203 PROPELLANT

Lot No.	Charge No.	KI (Min.)	Alka.	Acidity	H_2O	N_2
Requirements MIL-N-246B		10 Min	0.002% Max		0.5% Max	18.40% Min
RAD79E069962 (Cont'd)	9	--				
	10	17				
	11	16				
	12	17				
	13	15				
	14	--				
	15	18				
	16	16				
	17	19				
	18	17				
	19	16				
	20	18	None		.55	18.40
	21	17				
	22	16				
	23	--				
	24	17				
	25	15				
	26	--				
	27	18				

NITROGLYCERIN
M30A1 F/155MM, M203 PROPELLANT

Lot No.	Charge No.	KI (Min.)	Alka.	Acidity	H_2O	N_2
Requirements MIL-N-2468		10 Min	0.002% Max		0.5% Max	18.40% Min
KAU79L-069992	17	16				
	18	15				
	19, 20, 21	17				
	23	--				
	24	16				
	25	17				
	26, 27	19				
	28	--				
	29	18				
	30-	17	None		.27	18.47
	31	17				
	32	--				
	1, 2, 3	17				
	4	18				
KAU79M-069994	5, 6	18				
	7, 8	--				
	9	16				
	10	17	None		.45	18.42
	11, 12	17				
	13, 14	16				
	15	--				

NITROGLYCERIN
M30A1 f/155MM, M203 PROPELLANT

Lot No.	Charge No.	KI (Min.)	Alka.	Acidity	H_2O	N_2
Requirements MIL-N-246B		10 Min	0.002% Max		0.5% Max	18.40% Min
RAD79M-069994 (Cont'd)	16, 17, 18	17				
	19	17				
	20	--	None		.36	18.47
	21, 22, 23	17				
	24	17				
	25	--				
	26, 27, 28	17				

NITROGUANIDINE
M30A1 Propellant f/155mm, M203

Propellant Lot No.		77C-069005						77C-069005					
RAAP Lot (NPC No.)							1529						1530
CCL-Lot No. (Mfg. Lot No.)		13-855	13-856	13-857	13-858	13-859		13-875	13-876	13-877	13-878	13-879	
Parameters	Limits												
Avg. Particle Dia.,	3.4 - 6.0	5.3	5.3	4.7	4.6	4.7	---	5.5	4.9	5.9	5.1	4.3	6.03
Purity, %	99.0 min	99.8	99.8	99.7	99.8	99.8	---	99.8	99.8	99.7	99.8	99.8	99.3
Ash Content, %	0.30 max	0.03	0.03	0.02	0.05	0.02	---	0.06	0.02	0.02	0.05	0.05	0.09
pH Value	4.5 - 7.0	5.0	5.4	5.0	5.7	5.0	---	5.9	5.2	5.4	5.1	4.9	5.60
Acidity (H_2SO_4EQ), %	0.06 max	0.01	0.01	0.02	0.01	0.01	---	0.02	0.01	0.01	0.01	0.01	0.01
Total Volatiles, %	0.25 max	0.06	0.09	0.06	0.09	0.08	---	0.09	0.13	0.10	0.10	0.08	0.14
Sulfates (Na_2SO_4EQ), %	0.20 max	0.05	0.03	0.02	0.04	0.04	---	0.07	0.09	0.06	0.08	0.06	0.12
Water Insoluble, %	0.20 max	0.03	0.01	0.04	0.02	0.02	---	0.05	0.02	0.03	0.05	0.04	---
SOURCE		CYANAMID OF CANADA - DIRECT						CYANAMID OF CANADA - DIRECT					
Mo/Yr of Manufacture		5/77	5/77	5/77	5/77	5/77		5/77	5/77	5/77	5/77	5/77	5/77
Mo/Yr Received at RAAP		6/77	6/77	6/77	6/77	6/77		6/77	6/77	6/77	6/77	6/77	6/77

NITROGUANIDINE
M30A1 Propellant f/155mm, M203

Propellant Lot No.		270-069005						270-069005					
RAAP Lot (WPC No.)							1538						1532
CCL-Lot No. (Mfg. Lot No.)		13-890	13-891	13-892	13-893	13-894		13-880	13-881	13-882	13-883	13-884	
Parameters	Limits												
Avg. Particle Dia.,	3.4 ~ 6.8	5.4	4.8	4.8	4.8	4.8	---	4.6	5.3	5.6	5.6	5.3	---
Purity, %	99.0 min	99.7	99.8	99.9	99.8	99.7	---	99.7	99.7	99.7	99.8	99.8	---
Ash Content, %	0.30 max	0.03	0.01	0.02	0.06	0.05	---	0.09	0.06	0.07	0.02	0.01	---
pH Value	4.5 ~ 7.0	5.8	5.6	5.1	5.1	5.8	---	5.4	5.1	5.4	5.2	5.3	---
Acidity (H_2SO_4EQ), %	0.06 max	0.02	0.01	0.01	0.01	0.02	---	0.01	0.02	0.01	0.02	0.01	---
Total Volatiles, %	0.25 max	0.08	0.09	0.07	0.06	0.07	---	0.08	0.10	0.05	0.05	0.07	---
Sulfates (Na_2SO_4EQ), %	0.20 max	0.03	0.08	0.02	0.06	0.07	---	0.08	0.08	0.09	0.08	0.07	---
Water Insoluble, %	0.20 max	0.05	0.02	0.01	0.02	0.04	---	0.06	0.04	0.08	0.01	0.04	---
SOURCE		CYANAMID OF CANADA - DIRECT						CYANAMID OF CANADA - DIRECT					
Mo/Yr. of Manufacture		6/77	6/77	6/77	6/77	6/77		6/77	6/77	6/77	6/77	6/77	
Mo/Yr. Received at RAAP		6/77	6/77	6/77	6/77	6/77		6/77	6/77	6/77	6/77	6/77	

NITROGUANIDINE
M30A1 Propellant f/155mm, M203

Propellant Lot No.		77H-069805						77H-069806					
RAAP Lot (NPC No.)							1535						1536
CCL-Lot No. (Mfg. Lot No.)		13-895	13-896	13-897	13-898	13-899		13-900	13-901	13-902	13-903	13-904	
Parameters	Limits												
Avg. Particle Dia.,	3.4 - 6.0	4.8	4.5	4.2	4.3	4.2	---	4.2	4.7	4.3	4.0	4.1	---
Purity, %	99.0 min	99.7	99.7	99.8	99.7	99.7	---	99.6	99.7	99.7	99.7	99.8	---
Ash Content, %	0.30 max	0.05	0.02	0.04	0.07	0.06	---	0.04	0.01	0.06	0.04	0.07	---
pH Value	4.5 - 7.0	5.9	5.6	5.4	5.8	5.2	---	5.9	6.0	6.5	5.7	5.1	---
Acidity (H_2SO_4EQ), %	0.04 max	0.01	0.01	0.01	0.01	0.01	---	0.01	0.01	0.01	0.01	0.01	---
Total Volatiles, %	0.25 max	0.07	0.05	0.10	0.08	0.07	---	0.08	0.10	0.08	0.08	0.13	---
Sulfates (H_2SO_4EQ), %	0.20 max	0.05	0.09	0.07	0109	0.07	---	0.11	0.07	0.08	0.08	0.06	---
Water Insoluble, %	0.20 max	0.04	0.04	0.01	0.02	0.02	---	0.01	0.01	0.02	0.02	0.02	---
SOURCE		CYANAMID OF CANADA - DIRECT						CYANAMID OF CANADA - DIRECT					
Mo/Yr. of Manufacture		6/77	6/77	6/77	6/77	6/77		6/77	6/77	6/77	6/77	6/77	
Mo/Yr. Received at RAAP		6/77	6/77	6/77	6/77	6/77		6/77	6/77	6/77	6/77	6/77	

NITROGUANIDINE

M30A1 Propellant f/155mm, M292

Propellant Lot No.		77H-069806					1535	77H-069806					1536
RAAP Lot (MPC No.)													
CCL-Lot No. (Mfg. Lot No.)		13-905	13-906	13-907	13-908	13-909		13-910	13-911	13-912	13-913	13-914	
Parameters	Limits												
Avg. Particle Dia.,	3.4 - 6.8	4.4	4.6	4.2	4.1	4.1	---	4.3	4.1	4.5	4.3	4.6	---
Purity, %	99.0 min	99.7	99.9	99.8	99.9	99.8	---	99.8	99.7	99.7	99.8	99.7	---
Ash Content, %	0.30 max	0.05	0.03	0.05	0.04	0.04	---	0.02	0.05	0.10	0.01	0.06	---
pH Value	4.3 - 7.0	5.3	5.5	6.0	5.4	5.2	---	6.0	5.5	5.3	5.2	5.0	---
Acidity (H_2SO_4EQ), %	0.04 max	0.02	0.01	0.01	0.01	0.01	---	0.01	0.01	0.01	0.01	0.02	---
Total Volatiles, %	0.25 max	0.10	0.13	0.07	0.13	0.08	---	0.09	0.10	0.05	0.10	0.13	---
Sulfates (Na_2SO_4EQ), %	0.20 max	0.04	0.04	0.06	0.03	0.03	---	0.06	0.06	0.11	0.09	0.09	---
Water Insoluble, %	0.20 max	0.02	0.01	0.02	0 01	0.02	---	0.02	0.03	0.03	0.02	0.03	---
SOURCE		CYANAMID OF CANADA - DIRECT						CYANAMID OF CANADA - DIRECT					
No/Yr. of Manufacture		6/77	6/77	6/77	6/77	6/77		6/77	6/77	6/77	6/77	6/77	
No/Yr. Received at RAAP		6/77	6/77	6/77	6/77	6/77		6/77	6/77	6/77	6/77	6/77	

NITROGUANIDINE
M30A1 Propellant f/155mm, M203

Propellant Lot No.		77N-062806						77N-062807					
RAAP Lot (HPC No.)							1537						1538
CCL-Lot No. (Mfg. Lot No.)		13-920	13-921	13-922	13-923	13-924		13-915	13-916	13-917	13-918	13-919	
Parameters	Limit												
Avg. Particle Dia.,	3.4 - 6.0	4.3	4.8	4.9	4.3	5.2	—	4.8	4.7	5.1	4.7	4.5	—
Purity, %	99.0 min	99.8	99.6	99.8	99.7	99.8	—	99.8	99.8	99.9	99.8	99.7	—
Ash Content, %	0.30 max	0.07	0.08	0.05	0.03	0.03	—	0.10	0.07	0.01	0.06	0.09	—
pH Value	4.5 - 7.0	5.3	5.3	4.7	4.8	5.3	—	4.8	5.4	5.3	4.8	4.9	—
Acidity (H_2SO_4EQ), %	0.06 max	0.01	0.01	0.01	0.02	0.01	—	0.02	0.01	0.01	0.01	0.02	—
Total Volatiles, %	0.25 max	0.05	0.07	0.12	0.10	0.08	—	0.08	0.07	0.12	0.13	0.08	—
Sulfates (H_2SO_4EQ), %	0.20 max	0.06	0.13	0.07	0.04	0.04	—	0.08	0.06	0.04	0.08	0.08	—
Water Insoluble, %	0.20 max	0.01	0.08	0.02	0.11	0.04	—	0.02	0.04	0.03	0.04	0.04	—
SOURCE		CYANAMID OF CANADA - DIRECT						CYANAMID OF CANADA - DIRECT					
Mo/Yr. of Manufacture		6/77	6/77	6/77	6/77	6/77		6/77	6/77	6/77	6/77	6/77	
Mo/Yr. Received At RAAP		6/77	6/77	6/77	6/77	6/77		6/77	6/77	6/77	6/77	6/77	

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NITROGUANIDINE
M30A1 Propellant f/155mm, M203

Propellant Lot No.		77A-069007						77A-069007					
RAAP Lot (MFG No.)							1539						1540
CCL-Lot No. (Mfg. Lot No.)		13-930	13-931	13-932	13-933	13-934		13-935	13-936	13-937	13-938	13-939	
Parameters	Limits												
Avg. Particle Dia.,	3.4 - 6.0	4.6	5.0	5.3	5.2	5.1	---	5.4	4.9	4.4	4.4	5.0	5.60
Purity, %	99.0 min	99.8	99.0	99.6	99.8	99.8	---	99.8	99.6	99.8	99.9	99.8	99.15
Ash Content, %	0.30 max	0.03	0.03	0.01	0.04	0.05	---	0.01	0.08	0.07	0.03	0.04	0.06
pH Value	4.5 - 7.0	4.7	4.9	4.9	5.9	6.0	---	5.4	5.4	5.3	5.0	4.7	5.50
Acidity (H_2SO_4EQ), %	0.06 max	0.01	0.02	0.01	0.02	0.01	---	0.01	0.01	0.01	0.02	0.01	0.007
Total Volatiles, %	0.25 max	0.06	0.08	0.12	0.09	0.08	---	0.10	0.09	0.08	0.12	0.04	0.04
Sulfates (Na_2SO_4EQ), %	0.20 max	0.08	0.04	0.01	0.06	0.04	---	0.07	0.03	0.02	0.04	0.06	0.08
Water Insoluble, %	0.20 max	0.04	0.03	0.01	0.02	0.02	---	0.01	0.01	0.01	0.02	0.02	----
SOURCE		CYANAMID OF CANADA - DIRECT						CYANAMID OF CANADA - DIRECT					
Mo/Yr. of Manufacture		6/77	6/77	6/77	6/77	6/77		6/77	6/77	6/77	6/77	6/77	6/77
Mo/Yr. Received At RAAP		6/77	6/77	6/77	6/77	6/77		6/77	6/77	6/77	6/77	6/77	6/77

NITROGUANIDINE
M30A1 Propellant (/155mm, M203

Propellant Lot No.		TTH-069807						TTH-069807				
NAAP Lot (NPC No.)							1541					1542
CCL-Lot No. (Mfg. Lot No.)		13-925	13-926	13-927	19-928	13-929		8-041	8-042	8-056	8-574	
Parameters	Limits											
Avg. Particle Dia.,	3.4 - 6.0	4.9	4.6	5.0	4.8	4.3	---	4.4	5.3	4.7	4.4	---
Purity, %	99.0 min	99.7	99.8	99.8	99.8	99.8	---	99.7	99.8	99.7	99.8	---
Ash Content, %	0.30 max	0.04	0.04	0.04	0.03	0.02	---	0.03	0.16	0.04	0.11	---
pH Value	4.5 - 7.0	5.3	6.1	5.6	5.3	4.7	---	5.5	4.8	5.1	5.1	---
Acidity (H_2SO_4EQ), %	0.06 max	0.01	0.01	0.01	0.02	0.02	---	0.01	0.01	0.01	0.01	---
Total Volatiles, %	0.25 max	0.07	0.10	0.10	0.11	0.06	---	0.03	0.01	0.03	0.06	---
Sulfates (Na_2SO_4EQ), %	0.20 max	0.06	0.01	0.08	0.06	0.06	---	0.10	0.07	0.04	0.09	---
Water Insoluble, %	0.20 max	0.02	0.02	0.01	0.03	0.02	---	0.02	0.06	0.02	0.01	---
SOURCE		CYANAMID OF CANADA - DIRECT						RAVENNA AAP				
Mo/Yr. of Manufacture		6/77	6/77	6/77	6/77	6/77		10/76	10/76	10/76	10/76	
Mo/Yr. Received At RAAP		8/77	8/77	8/77	8/77	8/77		8/77	8/77	8/77	8/77	

NITROGUANIDINE
M30A1 Propellant f/155mm, M203

Propellant Lot No.		77M-069807						79D-069959			
RAAP Lot (NFC No.)							1343				1777
CCL-Lot No. (Mfg. Lot No.)		13-946	13-947	13-948	13-949	13-950		8-827	8-832	8-834	
Parameters	Limits										
Avg. Particle Dia.,	3.4 - 6.0	5.4	4.5	4.3	4.4	4.3	---	5.1	5.4	4.3	---
Purity, %	99.0 min	99.8	99.8	99.7	99.7	99.7	---	99.9	99.9	99.8	---
Ash Content, %	0.30 max	0.06	0.03	0.04	0.07	0.07	---	5.4	4.6	5.2	---
pH Value	4.5 - 7.0	5.8	5.5	6.3	5.7	5.8	---	5.4	4.6	5.2	---
Acidity (H_2SO_4EQ), %	0.06 max	0.01	0.01	0.01	0.01	0.01	---	0.01	0.01	0.01	---
Total Volatiles, %	0.25 max	0.11	0.11	0.10	0.06	0.12	---	0.15	0.10	0.12	0.12
Sulfates (Na_2SO_4EQ), %	0.20 max	0.06	0.07	0.14	0.04	0.07	---	0.05	0.05	0.07	---
Water Insoluble, %	0.20 max	0.03	0.02	0.01	0.04	0.04	---	0.01	0.01	0.02	---
SOURCE		CYANAMID OF CANADA - DIRECT						RAVENNA AAP			
Mo/Yr. of Manufacture		6/77	6/77	6/77	6/77	6/77		7/71	8/71	8/71	
Mo/Yr. Received At RAAP		7/77	7/77	7/77	7/77	7/77		1/79	1/79	1/79	

NITROGUANIDINE
M30A1 Propellant 8/155mm, M203

Propellant Lot No.		780-069959				780-069959				780-069959			
RAAP Lot (NFC No.)					1778				1779				1780
CCL-Lot No. (Mfg. Lot No.)		8-030	8-031	8-033		8-018	8-021	8-023		8-024	8-028	8-029	
Parameters	Limits												
Avg. Particle Dia.,	3.4 - 6.0	4.5	4.7	4.6	---	5.7	5.7	5.1	---	5.0	4.8	4.1	7.05
Purity, %	99.0 min	99.9	99.9	99.9	---	99.9	99.9	99.9	---	99.9	99.9	99.9	99.11
Ash Content, %	0.30 max	0.07	0.03	0.03	---	0.03	0.04	0.04	---	0.04	0.01	0.03	0.09
pH Value	4.5 - 7.0	5.4	5.1	4.9	---	5.0	5.2	5.3	---	5.1	5.5	5.7	5.30
Acidity (H_2SO_4EQ), %	0.06 max	0.01	0.01	0.01	---	0.01	0.01	0.01	---	0.01	0.01	0.01	0.02
Total Volatiles, %	0.25 max	0.04	0.16	0.03	0.13	0.14	0.13	0.07	0.07	0.09	0.06	0.10	0.05
Sulfates (Na_2SO_4EQ), %	0.20 max	0.07	0.06	0.10	---	0.07	0.07	0.06	---	0.05	0.09	0.10	0.05
Water Insoluble, %	0.20 max	0.01	0.01	0.01	---	0.01	0.01	0.01	---	0.01	0.01	0.01	---
SOURCE		RAVENNA AAP				RAVENNA AAP				RAVENNA AAP			
Mo/Yr. of Manufacture		7/71	8/71	8/71	8/71	7/71	7/71	7/71	7/71	7/71	7/71	7/71	7/71
Mo./Yr. Received At RAAP		1/79	1/79	1/79	1/79	1/79	1/79	1/79	1/79	1/79	1/79	1/79	1/79

NITROGUANIDINE
M30A1 Propellant 8/155mm, M203

Propellant Lot No.		79E-069960				79E-069960				79E-069960			
RAAP Lot (HPC No.)					1780				1781				1782
CCL-Lot No. (Mfg. Lot No.)		B-024	B-026	B-029		B-022	B-023	B-026		B-036	B-037	B-038	
Parameters	Limits												
Avg. Particle Dia.,	3.4 - 6.0					5.3	5.6	5.8	---	5.0	4.9	5.1	---
Purity, %	99.0 min					99.9	99.9	99.9	---	99.8	99.6	99.7	---
Ash Content, %	0.30 max					0.05	0.01	0.03	---	0.04	0.03	0.04	---
pH Value	4.5 - 7.0					5.5	4.9	5.1	---	5.0	5.2	4.8	---
Acidity (H_2SO_4Eq), %	0.06 max	Same as Lot 79D-069959	Same as Lot 79D-069959	Same as Lot 79D-069959	Same as Lot 79D-069959	0.01	0.01	0.01	---	0.02	0.01	0.02	---
Total Volatiles, %	0.25 max					0.06	0.07	0.16	0.07	0.07	0.08	0.08	0.03
Sulfates (H_2SO_4Eq), %	0.20 max					0.04	0.06	0.06	---	0.04	0.08	0.06	---
Water Insoluble, %	0.20 max					0.01	0.01	0.01	---	0.01	0.01	0.01	---
Source		---	---	---	---	RADFORD AAP				RADFORD AAP			
Mo/Yr. of Manufacture						7/71	7/71	7/71	7/71	8/71	8/71	8/71	8/71
Mo/Yr. Received At RAAP						2/79	2/79*	2/79	2/79	2/79	2/79	2/79	2/79

NITROGUANIDINE
M30A1 Propellant f/155mm, M203

Propellant Lot No.		79E-069960				79E-069960				79E-069961			
RAAP Lot (NPC No.)					1783				1784				1784
CCL-Lot No. (Mfg. Lot No.)		S-931	S-936	S-933		S-932	S-939	S-940		S-932	S-939	S-940	
Parameters	Limits												
Avg. Particle Dia.,	3.4 - 6.0	4.8	4.7	5.1	---	5.4	5.2	5.1	---				
Purity, %	99.0 min	99.8	99.7	99.8	---	99.9	99.8	99.8	---				
Ash Content, %	0.30 max	0.05	0.07	0.06	---	0.04	0.03	0.06	---				
pH Value	4.5 - 7.0	4.8	5.1	5.0	---	4.9	5.0	5.0	---				
Acidity (H_2SO_4EQ), %	0.06 max	0.02	0.02	0.02	---	0.02	0.02	0.02	---				
Total Volatiles, %	0.25 max	0.14	0.06	0.05	0.08	0.04	0.06	0.16	0.06				
Sulfates (Na_2SO_4EQ), %	0.20 max	0.05	0.07	0.11	---	0.10	0.08	0.08	---				
Water Insoluble, %	0.20 max	0.01	0.01	0.01	---	0.01	0.01	0.01	---				
SOURCE		RAVENNA AAP				RAVENNA AAP				---	---	---	---
Mo/Yr. of Manufacture		8/71	8/71	8/71	8/71	8/71	8/71	8/71	8/71				
Mo/Yr. Received At RAAP		2/79	2/79	2/79	2/79	2/79	2/79	2/79	2/79				

Same as propellant Lot 79E-069960 | Same as propellant Lot 79E-069960 | Same as propellant Lot 79E-069960 | Same as propellant Lot 79E-069960

NITROGUANIDINE
M30A1 Propellant f/155mm, M203

Propellant Lot No.		79E-069961				79E-069961				79E-069961			
RAAP Lot (HPC No.)					1785				1786				1787
CCL-Lot No. (Mfg. Lot No.)		B-842	B-882	B-899		B-898	B-891	B-893		B-850	B-884	B-885	
Parameters	Limits												
Avg. Particle Dia.,	3.4 - 6.0	4.8	5.3	4.8	---	5.4	5.3	5.0	---	4.9	5.2	5.6	---
Purity, %	99.0 min	99.8	99.9	99.9	---	99.9	99.9	99.9	---	99.8	99.9	99.9	---
Ash Content, %	0.30 max	0.01	0.07	0.04	---	0.08	0.04	0.03	---	0.03	0.01	0.06	---
pH Value	4.5 - 7.0	4.8	5.2	5.0	---	5.1	4.8	5.1	---	5.2	4.9	5.3	---
Acidity (H_2SO_4EQ), %	0.06 max	0.01	0.02	0.02	---	0.02	0.02	0.02	---	0.01	0.02	0.02	---
Total Volatiles, %	0.25 max	0.12	0.03	0.08	0.08	0.06	0.10	0.10	0.08	0.12	0.07	0.10	0.06
Sulfates (H_2SO_4EQ), %	0.20 max	0.09	0.15	0.10	---	0.12	0.09	0.09	---	0.08	0.11	0.12	---
Water Insoluble, %	0.20 max	0.01	0.01	0.01	---	0.01	0.01	0.01	---	0.01	0.01	0.01	---
SOURCE		RAVENNA AAP				RAVENNA AAP				RAVENNA			
Mo/Yr. of Manufacture		8/71	8/71	8/71	8/71	8/71	8/71	8/71	8/71	8/71	8/71	8/71	8/71
Mo/Yr. Received At RAAP		2/79	2/79	2/79	2/79	2/79	2/79	2/79	2/79	2/79	2/79	2/79	2/79

NITROGUANIDINE
M30A1 Propellant (/155mm, M203

Propellant Lot No.		79E-069261			1788	79E-069262			1791	79E-069263			1792
RAAP Lot (RFC No.)													
CCL-Lot No. (Mfg. Lot No.)		B-948	B-951	B-952		B-976	B-979	B-980		B-981	B-982	B-984	
Parameters	Limits												
Avg. Particle Dia.,	3.4 - 6.0	4.5	4.9	4.7	--	5.1	5.1	5.0	---	4.7	4.5	5.4	---
Purity, %	99.0 min	99.8	99.8	99.8	--	99.9	99.9	99.9	---	99.8	99.8	99.9	---
Ash Content, %	0.30 max	0.05	0.02	0.02	---	0.04	0.05	0.05	---	0.04	0.06	0.05	---
Acidity (H_2SO_4EQ), %	0.06 max	0.01	0.01	0.01	---	0.01	0.01	0.01	---	0.02	0.02	0.01	---
Total Volatiles, %	0.25 max	0.06	0.10	0.08	0.12	0.08	0.05	0.02	0.03	0.04	0.05	0.07	0.04
Sulfates (Na_2SO_4EQ), %	0.20 max	0.09	0.06	0.08	---	0.07	0.10	0.09	---	0.02	0.04	0.06	---
Water Insoluble, %	0.20 max	0.01	0.01	0.01	---	0.06	0.01	0.01	---	0.03	0.02	0.02	---
SOURCE		RAVENNA AAP				RAVENNA AAP				RAVENNA AAP			
Mo/Yr. of Manufacture		9/71	9/71	9/71	9/71	9/71	9/71	9/71	9/71	10/71	10/71	10/71	10/71
Mo/Yr. Received At RAAP		2/79	2/79	2/79	2/79	3/79	3/79	3/79	3/79	3/79	3/79	3/79	3/79

NITROGUANIDINE
M30A1 Propellant (.152mm, M2Q)

Propellant Lot No.		79E-069262				79E-069262				79E-069262			
BAAP Lot (NPC No.)					1795				1796				1795
CCL-Lot No. (Mfg. Lot No.)		B-971	B-972	B-973		B-931	B-932	B-943		B-932	B-941	B-942	
Parameters	Limits												
Avg. Particle Dia.,	3.4 - 6.0	5.0	4.6	4.5	--	5.8	5.0	5.0	---	5.2	5.4	5.0	---
Purity, %	99.0 min	99.7	99.8	99.8	---	99.7	99.8	99.7	---	99.8	99.7	99.6	---
Ash Content, %	0.30 max	0.06	0.05	0.05	---	0.05	0.04	0.06	---	0.06	0.08	0.05	---
pH Value	4.5 - 7.0	5.1	5.4	5.2	---	4.6	4.9	5.1	---	4.8	5.9	5.4	---
Acidity (H_2SO_4EQ), %	0.06 max	0.01	0.01	0.02	---	0.02	0.02	0.02	---	0.02	0.02	0.02	---
Total Volatiles, %	0.25 max	0.10	0.10	0.05	0.04	0.10	0.09	0.10	0.03	0.12	0.06	0.09	0.02
Sulfates (Na_2SO_4EQ), %	0.20 max	0.07	0.08	0.06	---	0.09	0.06	0.12	---	0.08	0.06	0.09	---
Water Insoluble, %	0.20 max	0.02	0.02	0.02	--	0.01	0.01	0.01	---	0.01	0.01	0.01	---
SOURCE		RAVENNA AAP				RAVENNA AAP				RAVENNA AAP			
Mo/Yr. of Manufacture		9/71	9/71	9/71	9/71	8/71	8/71	9/71	9/71	8/71	9/71	9/71	9/71
Mo/Yr. Received At BAAP		3/72	3/72	3/72	3/72	3/72	3/79	3/79	3/79	3/79	3/79	3/79	3/79

NITROGUANIDINE
M30A1 Propellant f/155mm, M203

Propellant Lot No.		79L-069992				79L-069992				79L-069992			
RAAP Lot (HPC No.)					1016				1017				1024
LAP-Lot No. (Mfg. Lot No.)		B-525	B-527	B-528		B-516	B-526	B-528		B-504	B-508	B-618	
Parameters	Limits												
Avg. Particle Dia.,	3.4 - 6.0	4.4	4.6	4.3	---	3.8	4.3	4.7	---	4.6	4.4	5.0	---
Purity, %	99.0 min	99.7	99.8	99.9	---	99.9	99.8	99.9	---	99.8	99.9	99.8	---
Ash Content, %	0.20 max	0.01	0.06	0.06	---	0.04	0.01	0.05	---	0.03	0.08	0.04	---
pH Value	4.5 - 7.0	5.0	5.3	5.0	---	5.0	5.2	5.0	---	5.1	5.5	5.4	---
Acidity (H_2SO_4EQ), %	0.04 max	0.01	0.01	0.01	---	0.01	0.02	0.01	---	0.01	0.01	0.01	---
Total Volatiles, %	0.25 max	0.10	0.10	0.05	0.01	0.09	0.05	0.08	0.05	0.06	0.10	0.06	0.04
Sulfates (H_2SO_4EQ), %	0.20 max	0.07	0.11	0.14	---	0.07	0.10	0.09	---	0.06	0.09	0.02	---
Water Insoluble, %	0.20 max	0.02	0.01	0.01	---	0.01	0.01	0.01	---	0.01	0.01	0.01	---
SOURCE		RAVENNA AAP				RAVENNA AAP				RAVENNA AAP			
Mo/Yr. of Manufacture		4/71	4/71	4/71	4/71	4/71	4/71	4/71	4/71	4/71	5/71	5/71	5/71
Mo/Yr. Received At RAAP		6/79	6/79	6/79	6/79	6/79	6/79	6/79	6/79	8/79	8/79	8/79	8/79

NITROGUANIDINE
M30A1 Propellant (/12Lbs. M292

Propellant Lot No.		79L-069992				79M-069994				79M-069996			
RAAP Lot (RPC No.)					1825				1825				1826
CCL-Lot No. (Mfg. Lot No.)		8-490	8-503	8-516		8-490	8-503	8-516		8-507	8-508	8-608	
Parameters	Limits												
Avg. Particle Dia.,	3.4 - 6.0	4.2	4.4	4.6	---	Same as propellant lot 79L-069992	Same as propellant lot 79L-069992	Same as propellant lot 79L-069992	Same as propellant lot 79L-069992	4.8	4.5	4.4	---
Purity, %	99.0 min	99.8	99.9	99.9	---					99.9	99.9	99.9	---
Ash Content, %	0.30 max	0.04	0.03	0.03	---					0.02	0.01	0.03	---
pH Value	4.5 - 7.0	5.5	5.3	4.8	---					5.6	5.7	5.4	---
Acidity (H_2SO_4Eq), %	0.06 max	0.01	0.01	0.02	---					0.01	0.01	0.01	---
Total Volatiles, %	0.25 max	0.02	0.07	0.06	0.08					0.09	0.06	0.04	0.14
Sulfates (Na_2SO_4Eq), %	0.20 max	0.07	0.08	0.07	---					0.10	0.10	0.09	---
Water Insoluble, %	0.20 max	0.01	0.01	0.01	---					0.01	0.01	0.01	---
SOURCE		RAVENNA AAP								RAVENNA AAP			
Mo/Yr. of Manufacture		4/71	4/71	4/71	4/71					5/71	5/71	5/71	5/71
Mo/Yr. Received At RAAP		8/79	8/79	8/79	8/79					8/79	8/79	8/79	8/79

NITROGUANIDINE
M30A1 Propellant 7/132mm, M203

Propellant Lot No.		79H-069994				79H-069994				79H-069994			
RAAP Lot (NPC No.)					1837				1838				1839
ULL-Lot No. (Mfg. Lot No.)		8-367	8-368	8-391		8-390	8-390	8-391		8-392	8-393	8-394	
Parameters	Limits												
Avg. Particle Dia.,	3.4 - 6.0	4.0	4.3	3.9	---	4.7	4.0	4.6	---	4.1	4.6	4.4	---
Purity, %	99.0 min	99.9	99.9	99.9	---	99.8	99.9	99.8	---	99.9	99.9	99.8	---
Ash Content, %	0.30 max	0.08	0.08	0.03	---	0.05	0.01	0.02	---	0.05	0.12	0.03	---
pH Value	4.5 - 7.0	5.0	5.2	5.1	---	5.4	5.4	5.5	---	5.0	4.9	5.3	---
Acidity (H_2SO_4EQ), %	0.06 max	0.01	0.01	0.01	---	0.01	0.01	0.01	---	0.01	0.02	0.01	---
Total Volatiles, %	0.25 max	0.04	0.08	0.04	0.12	0.08	0.06	0.05	0.12	0.04	0.02	0.08	0.17
Sulfates (Na_2SO_4EQ), %	0.20 max	0.12	0.10	0.12	---	0.08	0.08	0.11	---	0.10	0.07	0.11	---
Water Insoluble, %	0.20 max	0.01	0.01	0.01	---	0.01	0.01	0.02	---	0.01	0.01	0.01	
SOURCE		RAVENNA AAP				[illegible] AAP				[illegible] AAP			
Mo/Yr. of Manufacture		4/71	4/71	5/71		5/71	5/71	5/71	5/71	4/71	4/71	4/71	4/71
Mo/Yr. Received At RAAP		9/79	9/79	9/79	9/79	9/79	9/79	9/79	9/79	9/79	9/79	9/79	9/79

NITROGUANIDINE
N30A1 Propellant f/155mm, M203

Propellant Lot No.		TWI-969994			1852
RAAP Lot (HPC No.)					
CCL-Lot No. (Mfg. Lot No.)		11-935	11-926	11-937	
Parameters	Limits				
Avg. Particle Dia.,	3.6 - 6.8	4.6	5.0	4.6	---
Purity, %	99.0 min	99.3	99.8	99.8	---
Ash Content, %	0.30 max	0.00	0.01	0.05	---
pH Value	4.5 - 7.0	5.0	4.6	5.4	---
Acidity (H_2SO_4EQ), %	0.06 max	0.01	0.02	0.01	---
Total Volatiles, %	0.25 max	0.05	0.00	0.00	0.05
Sulfates (Na_2SO_4EQ), %	0.20 max	0.02	0.05	0.05	---
Water Insoluble, %	0.20 max	0.09	0.01	0.05	---
SOURCE		RAVENNA AAP			
Mo/Yr. of Manufacture		5/75	5/75	5/75	5/75
Mo/Yr. Received At RAAP		9/79	9/79	9/79	9/79

Ethyl Centralite
M30A1 Propellant 8/155mm, M203

Propellant Lot No.		77G-069805		77G-069806		77H-062807			79D-069939							
BAAP Lot (HPC No.)			1268		1268		1268	1269								1294
Mfg. Lot No.		20/77		20/77		20/77		21/77	63	64	65	66	67	68	69	
Parameters	Limits															
Solidification Point, °C	71.0-72.5	72.25	72.4					72.2	71.4	71.6	71.6	71.5	71.4	71.6	72.1	-
Melted Material (Appearance)	Bright Clear Liquid, Free of Scum & Deposit	Passes	Passes					Passes	Passes	Passes	Passes	Passes	Passes	Passes	Passes	-
Volatile Content, %	0.1 Max.	0.05	0.01	Same as for lot 77G-069805		Same as for lot 77G-069805		0.07 0.03	.097	.091	.092	.089	.081	.090	.082	.1
Ash Content, %	0.1 Max.	0.01	0.04					0.01	.002	.005	.002	.004	.006	.002	.008	..
Sum of Amines, %	0.20 Max.	0.12	0.002					0.10	.034	.043	.099	.048	.050	.129	.020	-
Acidity, as HCl, %	0.04 Max.	0.001	0.0004					0.001	.0001	.0001	.0001	.0001	.0001	.0001	.0001	-
Hydrolyzable Chlorine Compound, %	0.001 Max.	0.0002	None					0.0002	.0001	.0001	.0001	.0001	.0001	.0001	.0001	-
Particle Form, % Passing through USS No. 30 Sieve	99.9 Min.	99.9	100					99.9 100	99.96	99.92	99.93	99.91	99.95	99.97	99.92	99.5
Workmanship	Free from Grit, visible impurities, foreign matter	Passes	Passes					Passes	Passes	Passes	Passes	Passes	Passes	Passes	Passes	-

Ethyl Centralia
M30A1 Propellant 1/155mm, M203

Propellant Lot No. / RAAP Lot (WPC No.) / Mfg. Lot No.		79E-069960								79E-069961		79E-069962	
		70	71	72	73	74	75	76	77	1295	70 thru 77	1295	70 thru 77	1295
Parameters	Limits													
Solidification Point, °C	71.0-72.5	72.1	72.2	72.1	72.1	72.0	72.0	72.4	72.3	-				
Melted Material (Appearance)	Bright, Clear Liquid, Free of Scum & Deposit	Passes	Passes	Passes	Passes	Passes	Passes	Passes	Passes	-				
Volatile Content, %	0.1 Max.	0.095	0.082	0.092	0.093	0.098	0.092	0.066	0.067	0.04	Same as for lot 79E-069960		Same as for lot 79E-069960	
Ash Content, %	0.1 Max.	0.004	0.002	0.004	0.002	0.0005	0.002	0.008	0.008	-				
Sum of Amines, %	0.20 Max.	0.071	0.082	0.063	0.061	0.060	0.053	0.062	0.019	-				
Acidity, as HCl, %	0.04 Max.	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	-				
Hydrolyzable Chlorine Compound, %	0.001 Max.	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	-				
Particle Form, % Passing through US5 No. 30 Sieve	99.9 Min.	99.91	99.93	99.90	99.92	99.93	99.94	99.92	99.92	99.8				
Workmanship	Free from grit, visible impurities, foreign matter	Passes	Passes	Passes	Passes	Passes	Passes	Passes	Passes	-				

Ethyl Centralite
M30A1 Propellant f/155mm, M203

Propellant Lot No. RAAP Lot (HPC No.) Mfg. Lot No.		79L-069992										1297-R
		46R	86R	87R	88R	89R	90R	91R	92R	93R	94R	95R	
Parameters	Limits												
Solidification Point, °C	71.0-72.5	72.2	72.1	71.8	71.7	72.0	71.8	71.7	72.0	71.8	71.9	71.7	72
Melted Material (Appearance)	Bright, Clear Liquid, Free of Scum & Deposit	Passes	Passes	Passes	Passes	Passes	Passes	Passes	Passes	Passes	Passes	Passes	Passes
Volatile Content, %	0.1 Max.	0.078	0.085	0.082	0.084	0.091	0.081	0.085	0.097	0.094	0.091	0.084	0.04
Ash Content, %	0.1 Max.	0.000	0.001	0.001	0.002	0.002	0.002	0.002	0.0004	0.002	0.001	0.001	None
Sum of Amines, %	0.20 Max.	0.056	0.053	0.064	0.083	0.085	0.087	0.088	0.100	0.116	0.094	0.092	0.01
Acidity, as HCL, %	0.04 Max.	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0003
Hydrolyzable Chlorine Compound, %	0.001 Max.	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	None
Particle Form, % Passing through USS No. 30 Sieve	99.9 Min.	99.91	99.99	99.92	99.95	99.96	99.97	99.96	99.97	99.97	99.97	99.97	100
Workmanship	Free from grit, visible impurities, foreign matter	Passes	Passes	Passes	Passes	Passes	Passes	Passes	Passes	Passes	Passes	Passes	Passes

Potassium Sulfate
M30A1 Propellant f/155mm, M203

Propellant Lot No.		77G-069805	77H-069806	77H-069807		79D-069959		79E-069960	79E-069961	
RAAP Lot (HPC No.)		485R-1	486R-1	486R-1	487R-1	508R-1	509R-1	511R-1	511R-1	512R-1
Mfg. Lot No.		GFM	GFM	GFM	GFM	GFM	GFM	GFM	GFM	GFM
Parameters	Limits									
Purity, %	99.0 min.	-	-	-	-	-	-	-	-	-
K content, %	99.0 min.	-	-	-	-	-	-	-	-	-
Moisture, %	1.0 max.	0.01	0.005	0.005	0.01	0.02	0.02	0.02	0.02	0.01
Insoluble Matter, %	0.1 max.	-	-	-	-	-	-	-	-	-
Grit, %	None	-	-	-	-	-	-	-	-	-
pH	6-8	-	-	-	-	-	-	-	-	-
Chlorides, as KCl, %	0.02 Max.	-	-	-	-	-	-	-	-	-
Granulation, % Passing										
USS No. 50 Sieve	100 min.	-	-	-	-	-	-	-	-	-
USS No. 70 Seive	95 min.	-	-	-	-	-	-	-	-	-

Potassium Sulfate
M30A1 Propellant f/155mm, M203 (continued)

Propellant Lot No.		79E-069962		79L-069992		79M-069994	
RAAP Lot (HPC No.)		512R-1	513R-1		530		532
Mfg. Lot No.		GFM	GFM	715335		715337	
Parameters	Limits						
Purity, %	99.0 min.	-	-	99.6	99.84	99.2	-
K Content, %	99.0 min.	-	-	99.9	99.90	101.0	-
Moisture, %	1.0 max.	0.01	0.01	> 0.01	None	0.0	0.02
Insoluble Matter, %	0.1 Max.	-	-	> 0.004	0.01	< 0.1	-
Grit, %	None	-	-	None	None	None	-
pH	6-8	-	-	6.3	7	6.5	-
Chlorides, as KCL, %	0.02 Max.	-	-	> 0.02	None	< 0.02	-
Granulation, % Passing							
USS No. 50 Sieve	100 min.	-	-	100	100	100	100
USS No. 70 Sieve	95 min.	-	-	99.9	100	99	100

Graphite, Grade IV
M30A1 Propellant f/155mm, M203

Propellant Lot No.		79G-069805		79G-069806		79H-069807		79D-069959		79E-069960		79E-069961		79E-069962		79L-069992		79M-069994	
RAAP Lot (NFC No.)		127		127		127		134		135		135		135		136		136	
Mfg. Lot No.		3636	___	3636	___	3636	___	1099	___	2433	___	2433	___	2433	___	2888	___	2888	___
Parameters	Limits																		
Moisture, %	0.50 Max.	0.00	0.06					0.0	0.22	0.0	-					0.0	0.13		
Ash, %	6.0 Max.	1.91	-	Same as for lot 79G-069805		Same as for lot 79G-069805		1.13	-	1.20	-	Same as for lot 79E-069960		Same as for lot 79E-069960		1.54	-	Same as for lot 79L-069992	
Silica, %	2.75 Max.	0.58	-					0.65	-	0.58	-					1.10	-		
Other Grit, %	None	None	-					None	-	None	-					None	-		
Acidity, %	None	None	-					None	-	None	-					None	-		
Free Sulfur, %	0.05 Max.	None	-					None	-	None	-					None	-		
Total Sulfur, %	0.50 Max.	0.10						0.15	-	0.15	-					0.21	-		
Granulation, % Passing through USS No. 325 (44 µ) Sieve	96.0 Min.	97.4						97.8	96.13	96.2	-					98.0	-		

Acetone
M30A1 Propellant f/155mm, M203

M30A1 Lot No.	NPC Lot No.	Car No.	Supplier	Date	Hercules Analyses: Specific Gravity	Hercules Analyses: Moisture, %
SPECIFICATION LIMITS:					0.7910 to 0.7930	0.50% Max.
77G-069805	1212	GATX-75208	Ashland Chemical Co.	6-6-77	0.7917	0.39
77H-069806	1213	GATX-95502	" "	7-7-77	0.7919	0.43
77H-069807	1214	GATX-78953	" "	7-12-77	0.7915	0.36
	1215	GATX-85415	" "	7-19-77	0.7923	0.37
79D-069959	1251	GATX-17976	Devon Chemicals, Inc	2-26-79	0.7927	0.06
79E-069960						
79E-069961						
79E-069962						
79L-069992	1252	ACFX-81881	Ashland Chemical Co.	9-24-79	0.7928	0.42
79H-069994						

Alcohol
M30A1 Propellant f/155mm, M203

M30A1 Lot No.	HPC Lot No.	Car No.	Supplier	Date Rec'd.	Hercules Analysis Sp.Gr.	Toluene (%)	Alcohol (%)
SPECIFICATION LIMITS:					0.8163 Max.	0.75% Max.	94.9% Min.
77G-069805	646	CCBX-959	Union Carbide Corp.	6-13-77	0.8151	0.42	95.2
	647	CCBX-1065	" " "	6-20-77	0.8158	0.75	95.0
	648	GATX-87995	IMC Chemical Group, Inc.	6-28-77	0.8153	0.75	95.13
	649	CCBX-959	Union Carbide Corp.	6-29-77	0.8148	0.75	95.3
77H-069806	650	HATX-24805	IMC Chemical Group, Inc.	7-6-77	0.8152	0.75	95.15
	651	GATX-87993	" " " "	7-6-77	0.8147	0.75	95.28
77H-069807	652	GATX-87997	" " " "	7-15-77	0.8162	0.75	94.9
	653	GATX-99118	" " " "	7-22-77	0.8157	0.75	95.0
79D-069959	703	RAIX-6244	Union Carbide Corp.	2-19-79	0.8157	0.75	95.0
79E-069960	704	SCMX-2778	Shell Chemical Co.	4-2-79	0.8141	0.75	95.42
79E-069961	705	SCMX-2782	" " "	4-9-79	0.8142	0.75	95.41
	706	SCMX-2235	" " "	4-15-79	0.8135	0.75	95.6
79E-069962	707	SCMX-2778	" " "	5-3-79	0.8152	0.75	95.15
79L-069992	712	SCMX-2538	" " "	10-18-79	0.8150	0.75	95.2
79M-069994	714	SCMX-2782	" " "	11-7-79	0.8155	0.75	95.08
	715	SCMX-2778	" " "	11-19-79	0.8163	0.75	94.9

Process Conditions
M30A1 Propellant f/155mm, M203

Process	770-069003	770-069006	770-069007	79B-069959	77E-069960	79E-069961	79E-069962	791-069992	791-069995
NC Nitration	CIH	CIH	CIH	CIH	CIH	CIH	CIH	CIH	CIH
Dehydration:									
Quantity	1 tub	Same	Same	Same	Same	Same	Same	Same	Same
Alcohol, gals.	17 minimum								
Dwell Time, minutes	5								
Block Breaker & NC Weighing		Same	Same	Same	Same	Same	Same	Same	Same
Screen Opening	1/2 x 3/4"								
No. Tubs/Mix	4								
Dry NC Weight/tub, lb	37.0 ±0.5								
Total NC Dry Weight/mix, lb	148.0 ±2.0								
Premixing									
Type Premix	Schrader Bowl	Same	Same	Tub Mix	Same	Same	Same	Same	Same
No. Chgs./Premix	2			4					
Dry Wt. NC/Charge, lb	74.0 ±1.0			37.0 ±0.25					
Lq. Wt./Charge, lb	63.0 ±0.5			31.5 ±0.25					
Mixing Time, minutes	2			2					
Final Mixing									
Ingredient/Mix:									
Nitrocellulose, lb	148.00	Same	Same	Same	Same	Same	Same	Same	Same
Nitroglycerin, lb	126.00								
Nitroguanidine, lb	250.00								
Ethyl Centralite, lb	8.00								
Potassium Sulfate, lb	5.30								
total	537.30								
Solvents:									
Alcohol, lb	71.0								
Acetone, lb	47.0								
Temperature at Premixer	110 to 120°F								
Total Mixing Time, hrs.	3								
Drying	With inert gas								
Chilling of Mix	Reduce water temperature to 45 ±10°F and mix 15 minutes, minimum	Same	Same	Same	Same	Same	Same	Same	Same
Blocking									
Type Blocker	12" Press	Same	Same	Same	Same	Same	Same	Same	Same
Dwell Time, minutes	2 1/2								

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Process Conditions
M30A1 Propellant (/155mm, M203

Process	77G-069805	77H-069806	77H-069807	79D-069959	77E-069960	79E-069961	79E-069962	79L-069992	79H-069994
Forming									
Type Press	12"	Same	Same	Same	Same	Same	Same	Same	Same
No. Dies/press	5								
Die Inserts	Teflon or Delrin (2 1/2" barrel, 80° approach angle)								
Agate Size	0.470								
Pin Dia.	Outer: 0.039 Center: 0.031"								
Pin Circle	0.262								
No. Screens	1 - 16 mesh, 1 - 40 mesh								
Extrusion Pressure	2000 to 2600 psi								
Cutting									
Type Machine	Small Arms	Same	Same	Same	Same	Same	Same	Same	Same
Length, inch	0.949 ±0.005								
Wt./Tray, lb	25								
Trays/Cabinet	18								
Drying									
Trays/Bay	576	Same	Same	Same	Same	Same	Same	Same	Same
Loading Temp.	Ambient								
Build-up	5°F/hr								
Cycle Temp.	140°F								
Cycle Time	72 hrs								
Blending/Glazing	5400# Prop. 5 lb 6.4 oz Graphite 90 minutes	Same	Same	5400# Prop. 3 lb 0 oz Graphite 90 minutes	5400# Prop. 3 lb 0 oz Graphite 90 minutes or 4000# Prop. 2 lb 3.6 oz Graphite 90 minutes	Same	Same	Same	Same
Screening:									
Acceptance Screen, inch	0.700-0.980	Same	Same	Same	Same	Same	Same	Same	Same
Fine Screen, inch	0.315 Max.								
Wt./Fiber Drum, lb	100								
No. Drums/Batch	54								
Final Blending Time	10 min.	Same	Same	Same	Same	Same	Same	Same	Same
Packing									
Type Containers	Fiber Drums	Same	Same	Same	Same	Same	Same	Same	Same
Wt/Container	160 lbs	Same	Same	Same	Same	Same	Same	Same	Same

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Batch Data
M30A1 Propellant f/155mm, M203

Batch Numbers	TV, %	79G-069805 Closed Bomb at 90°F RQ, %	79G-069805 Closed Bomb at 90°F RF, %	79G-069805 Closed Bomb at -40°F RQ, %	79G-069805 Closed Bomb at -40°F RF, %
1-10	0.04	97.62	99.82	96.41	99.26
11-20	0.04	97.46	99.69	--	--
21-30	0.21	98.20	100.15	94.37	98.24
31-40	0.31	98.29	99.79	--	--
41-50	0.12	97.12	100.16	94.29	98.20
51-60	0.20	95.90	100.32	--	--
Weighted Average	0.15	97.43	99.99	95.02	98.57
Final Lot	0.33	96.51	99.74	92.58	98.16

Batch Numbers	TV, %	77M-069806 Closed Bomb at 90°F RQ, %	77M-069806 Closed Bomb at 90°F RF, %	77M-069806 Closed Bomb at -40°F RQ, %	77M-069806 Closed Bomb at -40°F RF, %
61-70	0.23	96.89	99.98	93.83	98.47
71-80	0.23	99.55	100.15	--	--
81-90	0.14	96.70	99.65	91.83	97.69
91-100	0.16	95.97	99.80	--	--
101-110	0.13	96.08	99.73	92.57	97.59
111-119	0.18	97.41	99.85	--	--
	0.18	97.10	99.86	92.74	97.92
	0.34	96.35	99.44	92.44	97.93

		77M-069807			
120	0.18	97.41	99.85	--	--
121-130	0.13	96.64	99.69	93.00	97.81
131-140	0.11	95.60	99.23	--	--
141-150	0.17	96.60	99.51	93.22	98.65
151-160	0.20	95.31	99.78	--	--
161-170	0.14	95.41	99.93	93.40	98.39
171-176	--	--	--	--	--
Weighted Average	0.15	95.94	99.63	93.21	98.28
Final Lot	0.26	96.16	99.85	93.20	98.04

		79D-069959			
1-10	0.12	96.54	100.90	91.76	99.18
11-20	0.13	96.64	100.53	--	--
21-29	0.11	96.80	100.47	92.82	98.49
	0.12	96.66	100.64	92.26	98.85
	0.18	96.57	100.06	90.92	97.93

Batch Data
M30A1 Propellant f/155mm, M203

Batch Numbers	TV, %	79E-069960 Closed Bomb at 90°F RQ, %	79E-069960 Closed Bomb at 90°F RF, %	79E-069960 Closed Bomb at -40°F RQ, %	79E-069960 Closed Bomb at -40°F RF, %
30	0.11	96.80	100.47	92.82	98.49
31-40	0.15	96.61	100.05	--	--
41-50	0.16	95.55	99.96	89.61	97.64
51-60	0.10	95.71	100.45	--	--
61-70	0.12	95.63	100.40	91.16	98.55
71-80	0.13	97.82	100.79	--	--
81-90	0.19	97.08	100.46	91.88	98.42
91-99	0.15	96.86	100.51	--	--
Weighted Average	0.16	96.48	100.37	90.95	98.21
Final Lot	0.07	96.45	100.39	91.62	98.91

Batch Numbers	TV, %	79E-069961 Closed Bomb at 90°F RQ, %	79E-069961 Closed Bomb at 90°F RF, %	79E-069961 Closed Bomb at -40°F RQ, %	79E-069961 Closed Bomb at -40°F RF, %
100	0.15	96.86	100.51	--	--
101-110	0.12	97.04	100.35	91.51	98.23
111-120	0.27	97.05	100.63	--	--
121-130	0.19	97.03	100.38	93.20	99.05
131-140	0.15	97.59	100.55	--	--
141-150	0.22	95.42	100.07	91.68	98.19
151-160	0.11	96.10	99.61	--	--
161-168	0.13	97.38	100.42	92.89	98.48
	0.17	96.79	100.29	92.29	98.49
	0.18	96.12	100.16	91.30	98.57

Batch Numbers	TV, %	79E-069962 Closed Bomb at 90°F RQ, %	79E-069962 Closed Bomb at 90°F RF, %	79E-069962 Closed Bomb at -40°F RQ, %	79E-069962 Closed Bomb at -40°F RF, %
169-170	0.13	97.38	100.42	92.89	98.48
171-180	0.10	98.09	100.69	--	--
181-190	0.17	96.64	100.00	91.98	98.19
191-200	0.14	95.56	100.58	--	--
201-210	0.14	96.01	100.16	91.65	98.78
211-220	0.10	96.09	100.08	--	--
221-230	0.15	96.17	100.08	92.17	98.46
Weighted Average	0.13	96.47	100.27	91.99	98.48
Final Lot	0.13	96.17	100.17	92.24	98.43

Batch Numbers	TV, %	RAD79L-069992 Closed Bomb at 90°F RQ, %	RAD79L-069992 Closed Bomb at 90°F RF, %	RAD79L-069992 Closed Bomb at -40°F RQ, %	RAD79L-069992 Closed Bomb at -40°F RF, %
231-240	0.12	95.05	100.51	89.73	98.59
241-250	0.13	93.96	99.88	--	--
251-260	0.13	94.38	100.11	90.32	97.61
	0.13	94.46	100.17	90.03	98.10
	0.12	94.13	99.63	89.72	97.71

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Batch Data
M30A1 Propellant f/155mm, M203

79M-069994

Batch Numbers	TV, %	Closed Bomb at 90°F RQ, %	Closed Bomb at 90°F RF, %	Closed Bomb @ -40°F RQ, %	Closed Bomb @ -40°F RF, %
216-270	0.10	94.18	100.01	--	--
271-280	0.11	93.33	99.86	89.17	98.16
281-290	0.13	93.94	99.98	--	--
291-300	0.13	94.67	100.16	89.69	98.09
301-310	0.09	94.07	100.25	--	--
311-316	--	--	--	--	--
Weighted Average	0.11	94.09	100.02	89.43	98.13
Final Lot	0.15	94.33	100.30	89.40	98.25

PRODUCTION LOTS
M30A1 E/155MM, M203

COMPOSITION	REQUIREMENTS	RAD77G-069805	RAD77H-069806	RAD77H-069807	RAD79D-069959	RAD79E-069960	RAD79E-069961	RAD79E-069962	RAD79L-069962	RAD79M-069994
Nitrocellulose	28.00 ± 1.30	27.18	28.00	27.74	27.43	27.76	28.16	28.65	26.90	28.17
Nitroglycerin	22.50 ± 1.00	22.80	22.36	22.53	22.95	22.56	22.23	22.49	23.48	22.45
Nitroguanidine	47.00 ± 1.00	47.54	47.06	47.04	46.93	47.20	47.04	46.29	46.97	46.86
Ethyl Centralite	1.50 ± 0.10	1.55	1.56	1.58	1.55	1.51	1.51	1.46	1.53	1.49
Potassium Sulfate	1.00 ± 0.30	0.93	1.02	1.11	1.14	0.97	1.06	1.11	1.12	1.03
TOTAL		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total Volatiles	0.05 Max	0.33	0.34	0.26	0.18	0.07	0.18	0.03	0.12	0.15
Graphite (Glaze)		0.08	0.10	0.12	0.05	0.07	0.06	0.07	0.07	0.05
Stability	40" Min.	60"	60"	60"	60"	60"	60"	60"	60"	60"
Bulk Density		--	--	--	--	--				
GRAIN DIMENSIONS										
Length (L)		0.9481	0.9529	0.9531	0.9514	0.9568	0.9585	0.0695	0.953.	0.9529
Diameter (D)		0.4173	0.4170	0.4166	0.4143	0.4145	0.4145	0.4167	0.4170	0.4184
Perforation Dia. (d)		0.0338	0.0338	0.0336	0.0340	0.0343	0.0330	0.0335	0.0342	0.0336
Inner Web (Wi)		0.0793	0.0776	0.0783	0.0771	0.0777	0.0792	0.0779	0.0776	0.0782
Outer Web (Wo)		0.0806	0.0817	0.0812	0.0814	0.0796	0.0813	0.0821	0.0811	0.0819
Avg. Web (Wa)		0.0800	0.0796	0.0797	0.0793	0.0786	0.0803	0.0800	0.0793	0.0801
Web Diff.	15 Max	2	5	4	5	2	3	5	4	5
L/D	2.10-2.50	2.27	2.29	2.29	2.30	2.31	2.31	2.31	2.29	2.28
D/d	5.0-1.5	12.4	12.3	12.4	12.2	12.1	12.6	12.5	12.2	12.4
L. Unif.	6.25 Max	1.08	0.82	0.64	1.29	1.16	0.93	1.07	0.98	0.72
D. Unif.	3.125 Max	1.28	1.25	1.57	0.95	1.12	1.19	1.01	1.58	1.10
CLOSED BOMB										
RQ, 90°F		96.51	96.35	96.16	96.57	96.45	96.12	96.17	94.13	94.33
RF, 90°F		99.74	99.44	99.85	100.06	100.39	100.16	100.17	99.63	100.30
RQ, -40°F		92.58	92.44	93.20	90.92	91.62	91.30	92.24	89.72	89.40
RF,-40°F		98.16	97.93	98.04	97.93	98.91	98.57	98.43	97.71	98.25
DIE DIMENSIONS										
Agate		0.470	0.470	0.470	0.470	0.470	0.470	0.470	0.470	0.470
Pin (Center)		0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037
Pin (Outer)		0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039
Pin Circle		0.262	0.262	0.262	0.262	0.262	0.262	0.262	0.262	0.262

SPECIAL TEST
M30A1 Propellant f/155mm, M203

Chemical	Formula	RAD 770-069906 Description Sheet	RAD 770-069906 Re-Test	RAD 770-069906 Conditioned @ 145° f/48 hrs in Closed Vessel	RAD 781-090027 Description Sheet	RAD 781-090027 Re-Test	RAD 781-090027 Conditioned @ 145°F f/48 hrs in Closed Vessel	RAD 781-090027 Conditioned @ 145°F f/48 hrs in Open Vessel	RAD791-069995 Description Sheet	RAD791-069995 Re-Test	RAD791-069995 Conditioned @ 145°F f/48 hrs in Closed Vessel	RAD791-069995 Conditioned @ 145°F f/48 hrs in Open Vessel
Nitrocellulose	28.00 ± 1.30	28.00	27.94		28.04	28.79			28.17	28.01		
Nitroglycerin	22.50 ± 1.00	22.36	22.59		22.20	22.31			22.45	22.46		
Nitroguanidine	47.00 ± 1.00	47.06	47.03		46.34	46.52			46.06	47.03		
Ethyl Centralite	1.50 ± 0.10	1.56	1.45		1.39	1.45			1.49	1.53		
Potassium Sulfate	1.00 ± 0.30	1.02	0.99		0.95	1.03			1.03	0.96		
Graphite	0.15 Max	0.10	0.11		0.11	0.12			0.08	0.08		
Total Volatiles	0.50 Max	0.34	0.15	0.13	0.10	0.16	0.18		0.13	0.14	0.14	
Heat Test (Min)	No. CC 40 Min	60'+	60'+		60'+	60'+			60'+	60'+		
Compressibility			23.00	20.30	29.66	28.36	32.44	32.63		30.43	33.43	30.81
Bulk Density (lb/ft)			62.081		62.167	61.412				63.2204		
HC (cal/gm)					983.6							
No Fumes			1 Hr			1 Hr				1 Hr		
PHYSICAL	Dies Used											
Length (L)	0.949	0.9539	0.9676		0.950	0.968			0.9529	0.9368		
Diameter (D)	0.470	0.4170	0.4160		0.412	0.410			0.4104	0.4213		
Perf. Diam (d)	0.039	0.0338	0.0333		0.034	0.0349			0.0336	0.0348		
Inner Web (Wi)	0.0930	0.0776	0.0782		0.0769	0.0759			0.782	0.0772		
Outer Web (Wo)	0.0845	0.0817	0.0808		0.0791	0.0782			0.0819	0.0819		
Av. Web (Wa)	0.0888	0.0796	0.0795		0.0780	0.0770			0.0801	0.0795		
Web Diff. -%	15 Max	5%	3.318		3%	2.942			5%	5.932		
L/D	2.10-2.30	2.29	2.377		2.33	2.36			2.28	2.27		
D/d	5.0 to 15	12.3	12.49		12.0	11.75			12.4	12.09		
Mean Var. L	6.25 Max	0.87	1.26		0.78	0.54			0.72	0.93		
D	3.125 Max	1.25	1.62		1.12	1.32			1.10	1.65		
CLOSED BOMB												
145° RQ			99.10	99.19		101.09	101.33			96.83	97.05	
RF			100.69	100.68		100.56	101.27			101.06	101.26	
90° RQ		96.35	96.06		90.35	97.73			96.33	96.10		
RF		99.44	99.39		99.86	99.43			100.30	99.07		
-40° RQ		92.44	90.92		94.67	92.00			89.40	89.16		
RF		94.93	97.50		90.75	90.31			90.25	97.67		

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[illegible]

BALLISTIC PERFORMANCE

Lot No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Chg. Assess. Series											
[illegible] - Wt. gr	[illegible]	[illegible]	[illegible]	N/A	[illegible]	[illegible]	N/A	[illegible]	N/A	N/A	[illegible]
Vel. fps	[illegible]	[illegible]	[illegible]	N/A	[illegible]	[illegible]	N/A	[illegible]	N/A	N/A	[illegible]
[illegible] - Wt. gr	[illegible]	[illegible]	[illegible]	N/A	[illegible]	[illegible]	N/A	[illegible]	N/A	N/A	[illegible]
Vel. fps	[illegible]	[illegible]	[illegible]	N/A	[illegible]	[illegible]	N/A	[illegible]	N/A	N/A	[illegible]
[illegible] - Wt. gr	[illegible]	[illegible]	[illegible]	N/A	[illegible]	[illegible]	N/A	[illegible]	N/A	N/A	[illegible]
Vel. fps	[illegible]	[illegible]	[illegible]	N/A	[illegible]	[illegible]	N/A	[illegible]	N/A	N/A	[illegible]
70° California Series											
Chg. Wt. gr	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Uncorr. Vel., fps	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Corr. Vel., fps	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Recommended Chg. Wt. gr. for [illegible] fps Vel.	N/A	418.22	[illegible]	N/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Max. Pressure [illegible] psi max		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Projectile wt. (lbs.)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]
145°F California Series											
Chg. Wt. gr.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]	[illegible]
Uncorr. Vel., fps	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]	[illegible]
Corr. Vel., fps	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]	[illegible]
Chamber Pressure	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]	[illegible]
Pressure Std. Dev.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]	[illegible]
-65°F California Series											
Chg. Wt. gr	N/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]	[illegible]
Uncorr. Vel., fps	N/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]	[illegible]
Corr. Vel., fps	N/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]	[illegible]
Chamber Pressure	N/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]	[illegible]
Pressure Std. Dev.	N/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]	[illegible]
COMPONENTS											
[illegible], Number	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]
Tube Number	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]
Case Number	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]
Recoil Number	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]
Proj. Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]
Proj. Lot	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]
Fuze Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]
Fuze Lot	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]
Primer Type	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]
Primer Lot	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]
[illegible] Prop.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	N/A	[illegible]
Test Date	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]

Attachment 16
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Appendix 4

Pressure Data of M30A1 Propellant f/155mm, M203

Lot Number	Test Date	$\bar{P}$145°F, psi	$\bar{P}$70°F, psi	$\bar{P}$-65°F, psi	Calib/Test	Rds
RAD-77G-069805	10/77	51500	45100	-		test
		49800	43900	-	calib	
RAD-77H-069806	3/78	50400	45500	44700		test
		51800	46700	46500	calib	
RAD-77H-069807	3/78	51200	46100	45500		test
		51800	46700	46500	calib	
RAD-79D-069959	4/79	51400	42200	40000		test
		49200	44200	44500	calib	
RAD-79E-069960	9/79	53200	44500	43100		test
		49800	46200	45000	calib	
RAD-79E-069961	9/79	52500	45200	44200		test
		49800	46200	45000	calib	
RAD-79E-069962	9/79	52600	44800	45700		test
		49800	46200	45000	calib	
RAD-79L-069992	1/80	51800	43500	40300		test
		-	44900	-	calib	
RAD-79M-069994	5/80	52500	43400	42000		test
		50000	45900	44200	calib	